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FOOD & MAN

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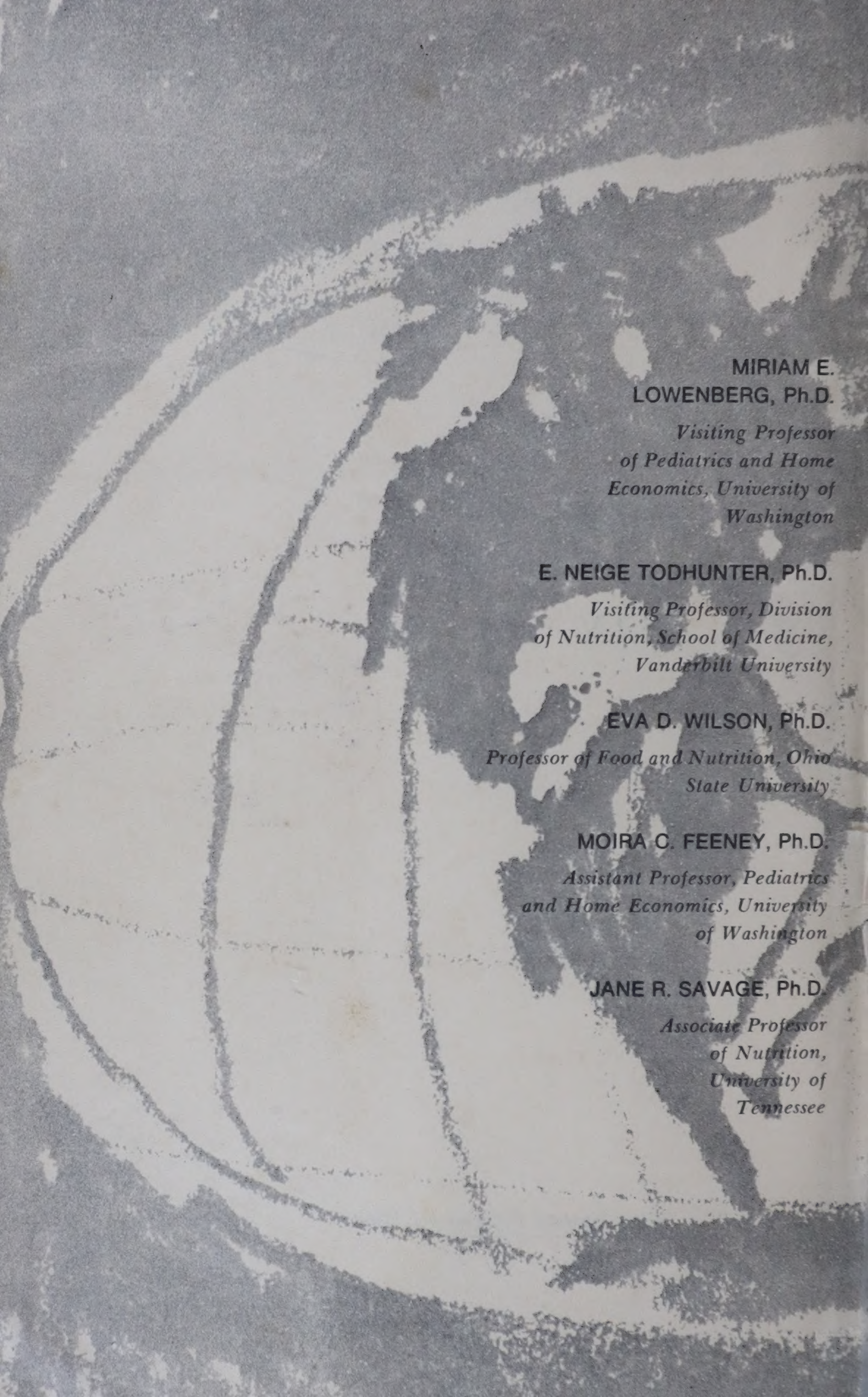

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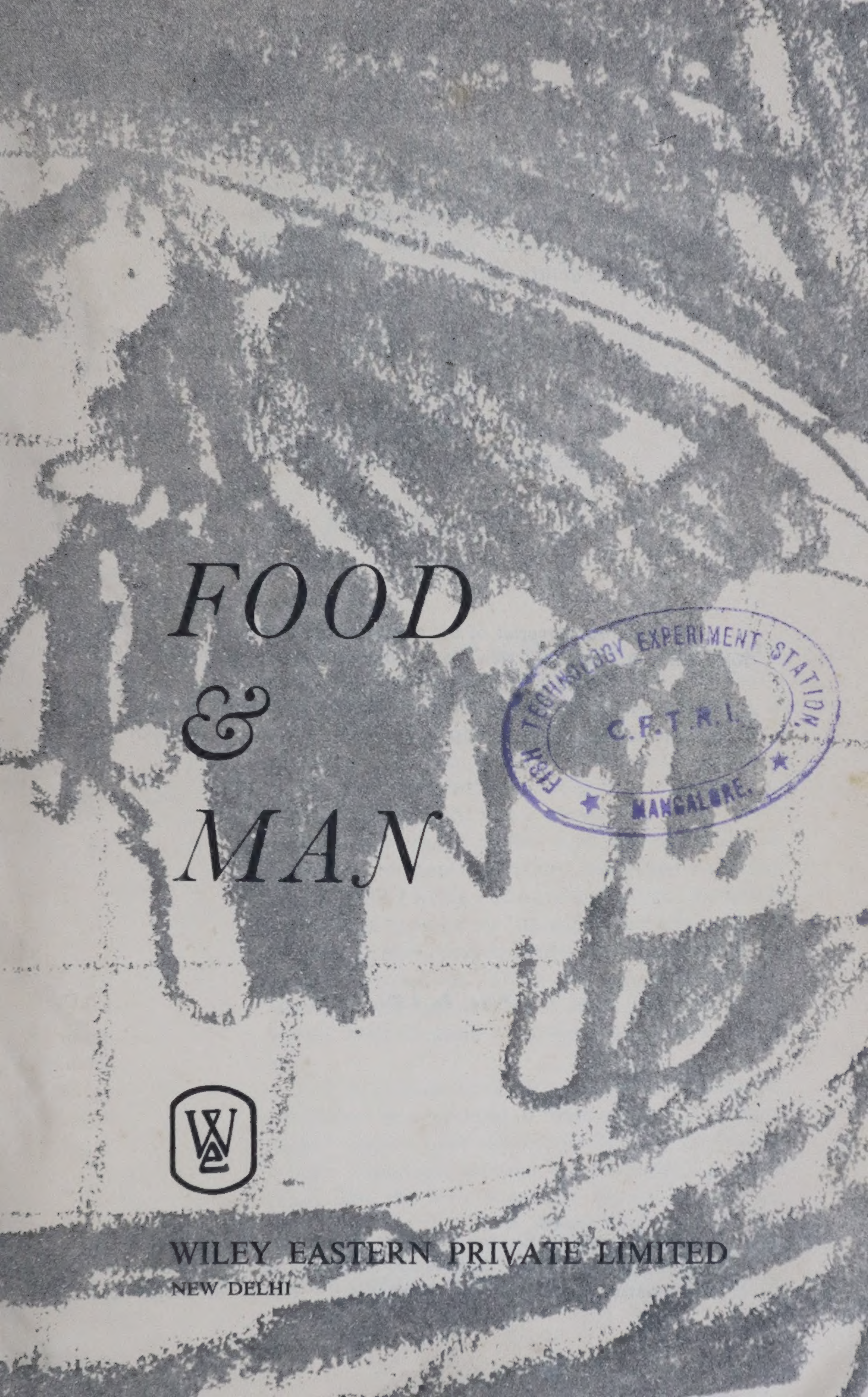

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To all who share our thoughtful concern for the importance of nutrition, be they students, fellow staffmembers, or friends, here and abroad, this book is dedicated.

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PREFACE

General courses in Foods and Nutrition now are offered in many universities and colleges to meet the needs of students in home economics as well as those in other areas of study. Such a general course may be the only course in foods and nutrition taken by students whose undergraduate major is in another specialty in home economics.

One early course of this type was developed at Pennsylvania State University and called Food and People. This I wrote and have now taught for nearly seven years to some two hundred and fifty students in college classes and to about three hundred in six summer workshops. These workshops have been taught at the Universities of Idaho, Hawaii, Puget Sound, West Virginia, Utah State, and Pennsylvania State.

The co-authors have all participated in the development and teaching of these courses; some have taught similar ones elsewhere. Dr. Eva D. Wilson taught a graduate seminar on the subject at Penn State, and she also wrote the lecture on Hunger which I always use. Dr. E. Neige Todhunter has, for a number of years, taught graduate work in this area at the University of Alabama. Her writings concerning the history of nutrition are well known. Dr. Moira C. Feeney, as a doctoral candidate, assisted me in many ways to teach the college course. She wrote the lecture on Food in Historical Perspective for me. Dr. Jane R. Savage is at present teaching a similar course at the University of Tennessee; as a student in my workshop at Utah State University she wrote a paper on Food, Man, and Religion. When I thought of choosing co-authors, I at once knew whom I wanted. Fortunately the present four all accepted at once.

The topics covered in the present volume are those which I have used in my teaching. These topics were chosen because they relate to the following main concerns of this book.

1. Problems in nutrition such as hunger and malnutrition.
2. Solutions currently being tried or projected. These include those of national, international, and voluntary agencies whose primary purpose is to relieve hunger and malnutrition. In these programs, nations and people can work together for mutual benefit.
3. The background of these problems. An understanding of this background can lead to more effective solutions. We need to understand food customs and the influence of culture and religion, among other things, on food habits and foodways.
4. The history of how man has fed himself and proposes to do so in the future. Needed, too, is knowledge of man's endeavor to understand the nutritive needs of his body.

Who have been the students in these classes and workshops? On what kinds of groups has this approach been tried? Their interests have varied widely. There have been graduate and undergraduate home economics students as well as teachers of the subject at the elementary, high school, and college levels. Public health nutritionists, nutrition workers in home economics extension programs, and hospital dietitians have been enrolled and have showed an interest in this course. Some of the most interested students, however, have come from outside the field of home economics. They have been from public health nursing, sociology, psychology, and English literature as well as other areas.

It has occurred to me during the past seven years that this approach has merits in providing an interesting and vital introduction to the subject which can intrigue the student to discover the great importance of nutrition and food to man everywhere. Some of the students new to the field have later elected to take other food and nutrition courses. Doors have been opened for them and they have had new interests developed. Most students have responded enthusiastically to the course, making it an exciting one to teach.

In this teaching, several ideas have been developed which may prove helpful to others teaching similar courses. These ideas are offered here.

1. The use of films on a variety of subjects where foods and nutrition are emphasized. There are many well-made films showing people of different cultures using food in their own ways. The films on the Bushman of Africa, for example, have proven especially helpful.
2. The use of novels, biographies, and books on travel, as well as cookbooks, which describe foods of particular cultural groups. These books have helped to provide new ideas and vistas to students.
3. The use of ideas and theories borrowed from the behavioral sciences which can be used to interpret food behavior.
4. The availability of a collection of books, some of which are not usually found in libraries, on foods and nutrition. These books can be from many allied fields. I have found my own library of some 500 pounds of books and materials most valuable in teaching workshops. I have gathered my collection from around the world and continue to add to it constantly. I find that the frustrations of students who have to spend hours looking for materials are thus eliminated. I believe, also, that when teachers build their own libraries they are likely to inspire students to do the same. Usually a book table has gradually had many interesting contributions from workshop students who thoughtfully wanted to share their books with fellow students.
5. The use of assigned projects suited to the students' present or projected needs. This procedure has proven valuable and is a good method of judging the student's understanding of the material he handles. To assist teachers, there are listed at the end of each chapter suggested topics for independent investigations.

Students have been encouraged to study one topic in depth. To start students off in this process, I recommend that several days be spent in browsing through materials.

Because this book is intended to be used by the college student who has no previous background in the physical or chemical sciences, the concepts are stated simply. The glossary at the end of the book may be used to look up unfamiliar terms.

If this book stimulates the reader to begin to understand the vital importance of food and nutrition to everyone on earth, it will have fulfilled its purpose.

The authors wish to thank John Charnow, Dr. D. B. Jellife, Dr. Arnold Schaefer, Dr. Katherine Bain, Dr. Ruth Leverton, and Dr. Bertyln Boseley as well as UNICEF, FAO, and WHO for their materials and criticisms so graciously furnished. The authors, however, assume full responsibility for the contents of this book.

Miriam E. Lowenberg

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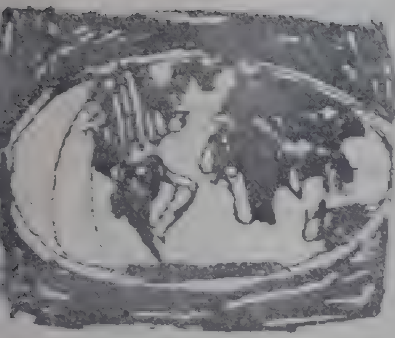

DEVELOPMENT OF MAN'S KNOWLEDGE OF NUTRITION

Our concern is with man and his food. Let us first look at man himself. What is man? This question has been asked throughout the ages. Philosophers and theologians have argued about the question. Scientists in medicine, anatomy, and physiology have dissected man, experimented on him, and treated him to see how he is put together. Social scientists have analyzed him to see how and why he behaves as he does. Educators have worked with him to discover how he learns.

Man has been classified in many ways. Your view of man probably depends on your background of education, training, and experience. Here is one viewpoint on man. He is:

Aggressive—his explorations, discoveries, and long history of wars speak for this characteristic.

Compassionate—the generous, sometimes self-sacrificing nature of what man will do for his fellowmen is attested to throughout history.

A reasoning, thinking being—the advances in science and our rich stores of knowledge are proof of this feature.

Creative—art, literature, music, architecture, and the inventions we are heirs to are results of this creativity.

Inquisitive—were it not for man's inquisitiveness, exploration of the earth and outer space and all the discoveries of science never could have been made.

A spiritual being—man's belief in some force, power, spirit, or God has placed him above all other creatures in the world.

Gregarious—family, home, community, and city life are evidence of this.

Communicative—powers of speech and written language further developed into all the mass media of communications are an essential part of man and his progress.

A physiological being—much of what man is and his actions depend on his physical structure and its physiological functioning.

At different periods in history, one or another of these characteristics of man has tended to be predominant. But always his physiological nature has expressed itself. Man's hunger drive is basic to his existence. Food determines his survival because food nourishes the body. There are many kinds of food and they differ widely in their nutritive value. Knowledge of the nutritive value of food is a twentieth-century achievement. Throughout the ages man ate what he could get. Undoubtedly it was by trial and error that civilized man gained some understanding of how foods differed; he learned from experience that certain kinds of food were necessary for health. But not until this century did man identify the different nutrient constituents in foods and learn how they were used physiologically for the highly complex processes in the body.

Always man's inquiring mind has asked: "What is it?" "Why?" "How?" His search for the answers to these questions about food in relation to health is the story of the development of the modern science of nutrition. Today, we can summarize the basic concepts in the simplest terms as follows:*

1. Nutrition is the food you eat and how the body uses it. We eat food to live, to grow, to keep healthy, and to get energy for work and play.
2. Food is made up of different nutrients needed for health and growth. All nutrients needed by the body are available through food. Many kinds and combinations of food can lead to a well-balanced diet. No food by itself, however, has all the nutrients needed for full growth and health. Each nutrient has specific uses

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*Statements made by the U.S. Interagency Committee on Nutrition Education.

in the body; most nutrients do their best work when teamed with other nutrients.

3. All persons have need for the same nutrients throughout life, but in varying amounts. The amounts of nutrients needed are influenced by age, sex, size, activity, and state of health. Suggestions for the kinds and amounts of food needed are made by trained scientists.
4. The way food is handled influences the amount of nutrients in food as well as its safety, appearance, and taste. Handling means everything that happens to food while it being grown, processed, stored, and prepared for eating. Each nutrient has a definite chemical structure, in many cases a complex one, and all nutrients enter into complex chemical reactions in the body.

WHY HISTORY?

History gives meaning to the present. Through knowledge of the past, we gain understanding of what is happening today. History has more than a utilitarian purpose; it is the record of the progress of man's endeavors and work, his ideas, visions, failures, and achievements. Athena sprang full armored from the head of Zeus according to Greek mythology, but knowledge never has sprung full fledged from the brain of man. It has been acquired step by step.

The history of nutrition is the story of men with questioning minds at work on the problems that affect the lives and health of all people. This is an exciting story interwoven with medicine, anatomy, physiology, chemistry, bacteriology, and agriculture. Men of almost every nationality contributed to the story because, as Pasteur said, "science knows no national boundaries." They were men of different temperaments and personalities, some with little formal education and others of high specialization; they were physicians, chemists, sailors, explorers, tradesmen, rich aristocrats, teachers, pharmacists, and lawyers. But they were all men with curiosity and a will to find the answers to questions that arose in their minds.

This chapter will deal with some of the high points of discoveries that have brought us to our present state of knowledge. We are not quite sure when the story began, but reliable records date back to early Greek and Roman times. The story can be pieced together through study of Babylonian and Egyptian tablets, ancient scrolls and papyri, journals of explorers and early voyagers, records of wars and famines, diaries and letters of men in all walks of life, scientific papers, and medical records.

Nutrition is a twentieth-century science. Since nutrition is vital to man's life and well being, why should nutrition be so late in developing? The answers are several:

1. Nutrition is dependent on the isolation and measurement of nutrients (chemical substances) which could be achieved only after the development of modern chemistry and the invention of scientific instruments for the quantitative study of minute amounts of chemicals present in food and the human body.
2. Nutrition deals with the living organism and its physiologic functions. Therefore, progress was dependent on advances in the biological sciences.
3. Much that is known about nutrition and health was learned from the study of disease, so progress in clinical medicine had to come first.
4. Man's concern for his fellowmen, rather than concern for science and technology as such, is a development of the twentieth century.

History without dates is meaningless. Dates help to put events in a time sequence and to relate them to other events. Make careful mental notes of dates as you read this chapter, but do *not* try to memorize them. Use them as a guide to increased understanding of man's progress in acquiring knowledge of food and its nutritional significance to his health and all his achievements.

THE BEGINNINGS OF MODERN SCIENCE

We start our story of the history of nutrition with the seventeenth century, often called the Golden Age of Science. This was when modern science began to develop because instruments were invented which made experimentation and measurement possible.

The Greeks and Romans believed in using diet in the treatment of disease, although they had no understanding of which foods were really helpful or why. An early Greek physician introduced the idea of four elements: fire, water, earth, and air. These four elements made up the four qualities: hot, dry, cold, and wet. But science could not progress far on such concepts as these. In the second century A.D., Galen, a physician from the Greek kingdom of Pergamos, dissected animals and wrote on the anatomy of man. He wrote many books on medical topics with so much authority that for the next twelve hundred years his teachings and writings were accepted as the final word on the subject.

From the time of the downfall of the Roman Empire (476 A.D.)

through the Middle Ages was the period of the spread of Christianity, and there was little attention to medicine or science. Voyages of exploration, particularly the discovery of America by Columbus (1492), turned men's thoughts to broader horizons. The invention of movable type in the fifteenth century made the printed word available to more people and thus helped the wider spread of knowledge and ideas.

And so we come to the seventeenth century. Elizabeth I, or "good Queen Bess" as she was sometimes called, died in 1603, and the reign of the Stuarts began in England. The period of ocean voyages and land discovery was now to be joined by a new type of discovery—scientific discovery. No longer were men willing to accept what Galen said; the voice of authority gave way to the experimental approach. Galileo in Italy (1564–1642) made a telescope to study the stars. Anton Leeuwenhock (1632–1723), the Dutch tradesman, spent his time grinding lenses and making a kind of microscope so that he was the first to see "little animals" in pond water. He studied all kinds of plant and animal tissue; he was a careful, patient observer who wrote simple, honest accounts of what he saw; and he was a man who described himself as having "a craving after knowledge which, I notice, resides in me more than in most men."

William Harvey (1578–1657) proved, by demonstration and carefully planned experiments, that the blood circulates through the body (1628), going from the heart by way of the arteries and returning by the veins. Harvey thus laid the foundation for later understanding of how food materials are transported to every cell in the body. Robert Boyle (1626–1691), the "father of chemistry," experimented for the joy of finding out things and invented an air pump. Sir Isaac Newton (1642–1727) gave us the theory of gravitation and wrote his great work on mathematics.

The experimental method, crude though it was at first, was now being used. Scientific societies were formed and had their scientific journals for reporting results of experiments. The *Mayflower* arrived in 1620 in what was to become the United States of America; Harvard College was founded in 1636. These are some of the high spots of the seventeenth century, the beginnings of science and freedom for men to use their inquiring minds and to test their ideas.

HOW FOOD IS CHANGED INTO MAN

Ham and eggs eaten by Susie Jones for breakfast are on their way to becoming Susie Jones. Magic? No—it is a process whereby the chemical constituents of food are rearranged within the body to form the chemical constituents that make up a human being. The complex and intricate processes are well understood today, but our current knowledge has been achieved only by patient study through the centuries. Sanctorius (1561–1636), an Italian physician, probably was the first man to do nutrition studies on humans. For weeks he weighed himself, his food, and all body excretions. But neither the equipment nor the basic information in science was available to help him solve the problem of differences between his body weight and what he ate and excreted. One hundred years passed before the next steps were taken to discover how food is changed into man.

Digestion

How could solid food be changed in the stomach or some other part of the digestive tract and then get into the blood stream to be circulated in the body? Many wondered about this problem. But how little it was understood is illustrated by the following statement:

> *Some physiologists will have it that the stomach is a Mill—others that it is a Fermenting Vat—others again that it is a Stew-pan—but in my view of the matter it is neither a Mill, a Fermenting Vat, nor a Stew-pan—but a stomach, Gentlemen, a Stomach.*

This was the way John Hunter (1728–1793), English surgeon and lecturer, informed his students and colleagues that he did not know what the stomach did.

A few men found some ways to try to answer the question. One of these was René Réaumur (1683–1757) of France. He was educated in law but could afford to study what interested him most, and that was natural science. He had a pet bird, a kite, which could regurgitate food after swallowing it. Réaumur made some metal cylinders and placed food inside them. Then he put wire grating at each end so that the food could not fall out but would still be exposed to the action of digestion in the stomach when swallowed. Meat was put into the tubes; when regurgitated by the bird, it was found to be partially dissolved. There was no odor of putrefaction, and the tubes showed no evidence of crushing or pressure, thus disproving the current theories that digestion was a grinding action and was putrefaction. Réaumur also put sponge in some of the tubes; in this way, he soaked up some of the gastric juices. He found that this juice was acid in nature and would partially dissolve meat in a test tube. New theories are slow to be accepted.

Although Réaumur's evidence did not change current ideas, he had introduced a new method of investigation.

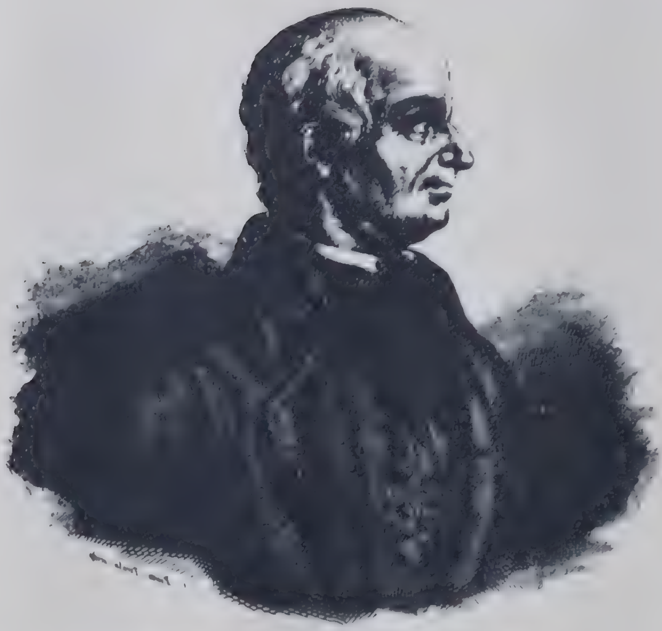
Twenty-five years later, Lazzaro Spallanzani (1729--1799) of Italy continued the work and methods begun by Réaumur and he also experimented on himself; he swallowed small linen bags containing meat and bread. He confirmed Réaumur's findings and wrote a book that showed that digestion was a chemical process and not fermentation.

The next big step forward came in 1822. It was the result of an accident, but a man with vision, curiosity, and scientific interest was there to take advantage of the unusual occurrence. The accident happened to Alexis St. Martin, a French Canadian trapper who was shot in the chest and abdomen. The young Army surgeon who treated him was William Beaumont; the place was a frontier village in northern Michigan; the time was 1822. Although the injury was believed to be fatal, Beaumont's treatment and care of the patient brought about his recovery. However, a small hole in the abdominal wall and into the stomach remained open. Through this opening Beaumont could insert a thermometer and measure the temperature; he could also see what foods and conditions stimulated the flow of gastric juice and the rate at which different foods were digested. He made 238 observations and experiments, and many of his inferences still are considered to be correct today. Undoubtedly Beaumont could have learned even more about the digestive process but, understandably perhaps, Alexis did not enjoy being studied in this way and went back to Canada.

Chemistry developed rapidly in the nineteenth century. Soon chemists were able to identify the acid in gastric juice as hydrochloric acid, but they also found that some other agent was responsible for the actual process of dissolving food. This agent was found to be an enzyme which was named pepsin (1835).

Calorimetry

What happens to food once it is absorbed and circulating in the bloodstream was even more puzzling than the question of digestion. At about the time Spallanzani was doing his experiments, this question was receiving the attention of Antoine Lavoisier (1743–1794) in Paris. Other scientists (Priestley and Scheele) had discovered oxygen but did not understand it nor correctly identify it. Lavoisier discovered what oxygen really meant. Moreover, he had the vision to interpret, and the ability to systematize, the knowledge of his time so that modern chemistry could develop. At the height of his scientific career, Lavoisier was a victim of the French Revolution and was beheaded on the guillotine.

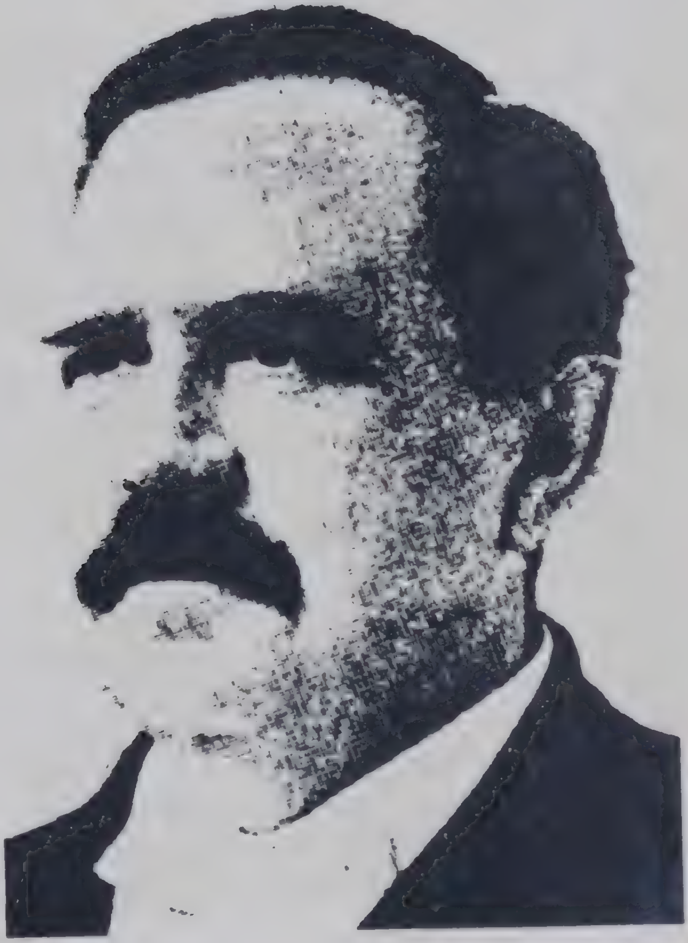


Lazzaro Spallanzani (1729–1799) of Italy; early investigator of physiology of digestion.

The work he started was continued by others. Lavoisier showed that accuracy in weighing on analytical balances and exact measurements were essential in science. And above all, for our story of nutrition, his experiments laid the foundation for understanding the processes going on inside the human body. For this he has been called the "father of nutrition."

Jean B. J. D. Boussingault (1802–1887) of France; first to conduct balance studies on animals.

Christian Eijkman (1858–1930) of Holland; Nobel prize winner for work leading to the discovery of vitamin B_1.



W. O. Atwater (1844–1907) of New York; earned the title "Father of American Nutrition."

Men of many nationalities and different fields of investigation laid the foundation for the science of nutrition. (Collections of the authors)

Breathing is natural to every one of us. Without air man dies. This was an ancient discovery. But what does air do and what is it? Men of the seventeenth century had tackled the problem and found that a lighted candle enclosed in a vessel was scon extinguished. Others enclosed a mouse in a jar of air over water and found that when part of the air was used up the mouse died. Lavoisier's experiments and his keen mind for interpreting what he found showed that breathing or respiration is a chemical process that uses up oxygen; we call this process oxidation. Oxygen is essential for the changing of food nutrients into the body structure of man. The sum of all these many chemical processes we call *metabolism*; Lavoisier was the first to measure metabolism in man. He measured the amount of oxygen consumed by his laboratory assistant when sitting at rest, and also the amount of carbon dioxide he breathed out at the same time. From these and other measurements on animals, Lavoisier was able to show that oxidation within the body is a source of heat and energy. Lavoisier's experiments also showed that more oxygen is used when one eats food and when one exercises or does work. This was the beginning of calorimetry or measurement of heat and work in the body which eventually led to the measurement of calorie values of foods.

Other scientists soon built on to the foundations of knowledge established by Lavoisier. The center of research passed for a time to a group of German scientists who first built a calorimeter large enough for a dog to be enclosed in and then one in which a man could be enclosed. The oxygen used and carbon dioxide exhaled could be measured precisely, as well as the body heat at all times and under differing conditions of diet and of work. Graham Lusk (1866–1932) of Connecticut studied calorimetry in Germany. When he returned to the United States he had a calorimeter built and then investigated the metabolism of healthy and diseased animals and children.

NUTRIENTS IN FOOD

The Search for Protein

Although a scientist discovered the gas called nitrogen in 1772, it was not known that this element had anything to do with nutrition until 1816. At that time a French physician and teacher of physiology, Francois Magendie (1783–1855) published some of his research findings. When he fed dogs single foods such as sugar and water or olive oil and water, the animals died. Magendie concluded that animals needed nitrogen in the diet. He know that both body tissues and many foods contained nitrogen, and he suggested that the nitrogen of the tissues probably came from food. The nitrogen-containing foods were called albuminous foods; just twenty-two years (1838) after Magendie's work a Dutch chemist, Mulder, gave the name "protein" to the nitrogen material in these albuminous foods.

The word "protein" comes from the Greek word meaning "first." But protein does not take first place in nutrition. No nutrient is first because nutrition requires that there be adequate amounts of a number of nutrients. However, protein is essential and children stop growing when it is not supplied in their diets. In many countries today, especially those dependent upon cereals and root crops, good quality protein is lacking and the health and vigor of the people are impaired. Kwashiorkor (described in Chapter 7), a disease of children, is associated with lack of protein and calories in food.

A new pathway was opened by this work on nitrogen-containing foods. Chemists began to identify the various constituents or building blocks that make up different proteins; these blocks are called amino acids. Some amino acids are essential—they must be supplied in food. Since all proteins do not contain all the essential amino acids, protein foods differ in their values.

Chemical analysis and animal feeding experiments have been the methods for learning about proteins. Albino rats have been used most frequently in the twentieth century because they are small, easily handled, grow rapidly and therefore show any deficiency quickly, and eat almost any kind of food mixture. Advances in chemistry make it possible to separate the pure constituents of food. By feeding these in varying combinations, we find what is necessary for an adequate diet. The amount of protein needed by animals or man can be measured. The amount of nitrogen is determined in the food that is eaten, and similar analysis for nitrogen is made on excreta. If what is consumed equals what is excreted, then there is obviously a balance and the diet is adequate. If more is excreted than is being eaten in food, then the body is losing protein and more must be eaten to meet the body's needs. Using these basic methods, rapid advances in knowledge of proteins have been made in the last fifty years. But research is still continuing on the amino acid makeup of foods, the amounts needed, and the various ways in which protein foods may be combined in the diet to provide all the amino acids. Although foods of animal origin are the best sources of the essential amino acids, recent studies have shown that a judicious mixture of different plant proteins can be made and that mixtures of cereals and other plant foods can be prepared that are nutritionally adequate (see Chapter 8).

Is Fat Necessary?

Carbohydrates—starches and sugars—form the basis of the diets of people the world over, except for the Eskimos in the Arctic regions where these foods will not grow. Cereals (wheat, rice, corn, oats, and barley) and tropical root plants are the easiest and cheapest of all foods to grow. Their great value is that they are a cheap source of calories, and calories are necessary to satisfy hunger and provide energy for man.

Fat was one of the earliest food substances to be recognized because of its oily or greasy nature. The fat on meat is readily seen as is the cream on milk. Oil, which is liquid fat, is found in nuts and the seeds of many plants such as cottonseed and soybean. These foods are usually more expensive to produce than are the cereals and root crops.

By the middle of the last century, scientists were beginning to look much more critically at proteins, fat, and carbohydrates, and to question how they were formed in the body, where they came from, and whether they were necessary in food. At first it was thought that the fat of an animal's body was obtained from fat in food. But farm animals grew fat eating grass, and grass certainly had little fat in it. Using the method of feeding diets of known food composition, Boussingault, in France, fed diets that were free from fat to geese; the geese grew well and stored fat in their bodies. He found the same results with ducks. In other countries, similar experiments with fat-free diets for dogs and farm animals gave clear evidence that the animal body can make fat from carbohydrate. The same is true for human beings. If the body is given more carbohydrates, that is more calories, than are needed for work and body functions, the excess is changed chemically in the metabolic processes to fat and is stored in the body as fat.

This does not mean that fat itself is unnecessary in the diet; fats are high in energy value, providing two and one-fourth times as many calories per unit of weight as do carbohydrates or proteins. Fats are enjoyed because they give flavor and palatability to food. Some fats carry certain vitamins and also an essential unsaturated fatty acid. Unsaturated means that in the chemical structure of this compound there are places in the molecule, or double bonds, where other atoms can be added.

Mineral Elements

The nineteenth century was the period of rapid discovery of different elements present in human tissues and fluids; the necessity of these elements for growth and health was demonstrated by feeding experiments with animals. Chemical analysis and feeding experiments were the pathways to discovery being used in laboratories in many countries. By these means a new group of substances, the ash constituents or mineral elements, was added to the list of nutrients needed by man. In the early 1800's, three classes of foodstuffs were recognized: saccharine, albuminous, and oleaginous. These we now call carbohydrates, proteins, and fats.

When plant material was burned it did not disappear entirely; some ash always remained. Chemists at this time (1800) began to look at this ash and try to find out what it was composed of. They were also curious about the chemical nature of bone, blood, and other body fluids. At the same time other investigators were using the new technique of feeding experiments with farm animals. One of these investigators was Boussingault (1802–1887), the French chemist, physicist, and mining engineer, to whom we have referred already. He is credited with being the first to apply knowledge of chemistry to the feeding of farm animals. In his experiments he compared the growth and health of animals when one lot was fed a diet containing ordinary salt and another lot received no salt. Salt made an obvious difference in the appearance and well being of the animals. In similar types of feeding experiments, he found that iron was essential in the diet.

Other investigators found that calcium and phosphorus were needed for skeletal growth. Iodine was discovered in the thyroid gland of man. Sheep died unless cobalt was present in the soil on which their food grew. Many men in many places indentified new mineral elements necessary for life, and new discoveries still are being made. At least sixteen of these elements are now known to be part of the body structure or the body fluids, and they must be supplied in man's daily food. Some of these, such as copper and manganese, are present in such small amounts that they have been called trace elements or microelements.

One more group of food nutrients had yet to be discovered and these were the vitamins. Although they were the last group of nutrients to be isolated and named, their story is perhaps the longest and started earlier in history than that of any other food constituent.

DEFICIENCY DISEASES AND DISCOVERY OF VITAMINS

Man's history has been marked by his struggle to obtain food and to ward off disease. Until this century, hunger, famine, and disease were major factors in keeping down the numbers of the population in many countries. Much disease has been eliminated or controlled since the discovery of the bacterial origin of disease and the development of sanitation, drugs, and antibiotics.

Another group of diseases is being eliminated through knowledge of nutrition; these diseases are called the dietary-deficiency diseases because we know that they are caused by the lack of vitamins or other nutrients in the diet. Some of these diseases such as scurvy, pellagra, and rickets have been known for centuries. Since 1912 the vitamin associated with each has been discovered, and that is the story told here.

Other dietary-deficiency diseases include beriberi, endemic goiter, and kwashiorkor. These are discussed in Chapter 7.

Scurvy

Scurvy has been known for centuries. Because it affected sailors on long voyages, it has been called the scourge of sailors. However, this disease has been just as much a calamity for soldiers, explorers, and civilian populations when they have been deprived of fresh foods, especially fruits and vegetables.

It is always easier to look back and see how and why problems existed than it is to understand them at the time. So it is natural to ask why there is no mention of scurvy in Columbus' voyage of discovery across the Atlantic in 1492. He had three ships with a complement of eighty-eight men. They sailed on September 6 and reached the West Indies October 12—a voyage of little over one month. They also stopped at the Canary Islands for repairs, fresh water, and food. Healthy men on a voyage of that length did not succumb to scurvy. But on longer voyages scurvy took its toll.

Vasco da Gama, the great Portuguese navigator, sailed from Lisbon in 1497 to the East Indies. He lost one hundred out of one hundred and sixty men while on a voyage around the Cape of Good Hope because his men were continuously at sea for four months without fresh food of any kind.

Jacques Cartier, the French explorer, is well remembered in the history of scurvy because he learned from the Indians how to cure it in his crew on their voyage during 1535 and 1536 to Canada.

> *During this period there died to the number of twenty-five of the best and most able seamen we had, who all succumbed to the aforesaid malady (scurvy). And at that time there was little hope of saving more than forty others, while the whole of the rest were ill, except three or four.*

Cartier saw an Indian walking about in good health whom he had seen ten days earlier ill with the same disease his men suffered from. The Indian told him that he "had been healed by the juice of the leaves of a tree and the dregs of these, and that this was the only way to cure sickness." Cartier obtained some branches of the tree and prepared the drink from it for his men.

> *As soon as they had drunk it, they felt better, which must clearly be ascribed to miraculous causes; for after drinking it two or three times, they recovered health and strength and were cured of all the diseases they had ever had. . . . in less than eight days a whole tree as large and as tall as any I ever saw was used up, and produced such a result, that had all the doctors of Louvain, and Montpelier been there, with all the drugs of Alexandria, they could not have done so much in a year as did this tree in eight days; for it benefited us so much that all who were willing to use it, recovered health and strength, thanks be to God.*

The particular tree used has not been identified with certainty. Some thought it to be the sassafras tree, others the hemlock. Leaves and twigs of pine, willow, and evergreens have been analyzed and shown to be good sources of vitamin C, the vitamin that cures scurvy.

Practical experience worked well for some voyagers. John Woodall, ship's surgeon, wrote a book in 1617 in which he gave advice for preventing scurvy: "The use of the juice of lemmons is a precious medicine and well tried, being sound and good." But Lord Anson, who sailed in 1740 with three ships to explore the Pacific and also to raid and capture Spanish galleons, paid no attention to such suggestions. He had a force of 961 officers and men; within a year 626 were dead, most of them from scurvy.

No matter how exciting the stories, descriptions, or folklore about foods or treatment of disease, science rightly demands experimental evidence before accepting statements. In the case of scurvy, this evidence was provided by Captain James Lind in his book, *A Treatise of the Scurvy*, published in 1753. Lind was the son of a Scottish merchant. He studied medicine, entered the Royal Navy, and became a ship's surgeon and then physician in charge of a Royal Naval hospital. He was a man noted for his clear thinking, knowledge, and ability. In his book we have the description of the first clinical experiment carried out under controlled conditions. It still stands today as a model of careful planning of a nutrition experiment with control of all conditions, completeness, and conciseness and accuracy of recording. It is worthy of study not only for its place in history and its information but also for its style. Lind wrote:

> *On the 20th of May 1747, I took twelve patients in the scurvy, on board the* Salisbury *at sea. Their cases were similar as I could have them. They all in general had putrid gums, the spots and lassitude with weakness of their knees. They lay together in one place, being a proper apartment for the sick in the fore-hold; and had one diet common to all viz., water-gruel sweetened with sugar in the morning; fresh mutton-broth often times for dinner; at other times puddings, boiled biscuit with sugar; and for supper, barley and raisins, rice and currants, sago and wine, or the like. Two of there were ordered each a quart of cyder a-day. Two others took twenty-five gutts of* elixir vitriol *three times a-day, upon an empty stomach; using a gargle strongly acidulated with for their mouths. Two others took two spoonfuls of vinegar three times a-day, upon an empty stomach; having their gruels and their other food well acidulated with it, as also the gargle for their mouth. Two of the worst patients, with the tendons in ham rigid (a symptom none of the rest had), were put upon a course of sea-water. Of this they drank half a pint every day, and sometimes more or less, at it operated, by way of gentle physic. Two others had each two oranges and one lemon given them every day. These they ate with greediness, at different times, upon an empty stomach. They continued but six days under this course, having consumed the quantity that could be spared. The two remaining patients took the bigness of a nutmeg three times a-day, of an electuary recommended by an hospital surgeon, made of garlic, mustard seed, balsam of Peru, and gum myrrh.*
>
> *The consequence was, that the sudden and visible good effects were perceived from the use of the oranges and lemons; one of those who had taken them, being at the end of six days fit for duty. . . . The other was the best recovered of any in his condition; and being now deemed pretty well, was appointed nurse to the rest of the sick. . . .*
>
> *As I shall have occasion elsewhere to take notice of the effects of other medicines in this disease, I shall here only observe, that the result of all my experiments was, that oranges and lemons were the most effectual remedies for this dis-*

> *temper at sea. I am apt to think oranges preferable to lemons, though perhaps both given together will be found serviceable.*

Despite this clear-cut evidence of the value of citrus fruit for curing scurvy, it was not until fifty years later that the Royal Navy adopted the regular practice of daily provision of lemon or lime juice for all sailors. And this is the origin of the term "limey," so long applied to British sailors and sometimes even today to anyone from England.

The Gold Rush days of California, 1849–1950, brought a sudden increase of 100,000 persons to that part of the country. Food shortages, especially of fruit and vegetables, developed quickly; the deaths from scurvy in the mining camps have been estimated conservatively at 10,000 men. The last part of the overland trail to California was marked with the graves of those who died of scurvy. It is of interest that scurvy and the Gold Rush were factors in starting the citrus industry of Southern California; the demand for lemons led some pioneers in 1849 to plant large orchards of citrus fruit.

Acceptance of new knowledge is sometimes very slow. Military forces apparently thought of scurvy as a sea disease and did not provide protection against it. Consequently, throughout Europe and America, the story of wars is also a record of scurvy. In the American Civil War, 30,714 cases of scurvy were reported and 338 deaths were attributed to this disease. In the Franco-Prussian War of 1870–1871 the besieged city of Paris suffered severely from scurvy. In the Russo-Japanese War, half the garrison of seventeen thousand soldiers suffered from scurvy after the siege of Port Arthur. In World War I, 1914–1918, thousands of troops were incapacitated by scurvy; it affected the armies of Russia, Turkey, Roumania, Germany, Austria, Italy, and France. The troops from India fighting in Mesopotamia with the British army had 7500 cases of scurvy in a nineteen-week period.

It has been said that "science knows no national boundaries." The same is true of scurvy and other dietary-deficiency diseases. Lack of an essential nutrient in the diet affects anyone no matter what his nationality, color, occupation, place of living, age, and sex. Scurvy often affected men more than women because the men were absent from home and regular meals and their hard work produced the effects more quickly. Today scurvy is not unknown in infants whose mothers fail to give them orange or other fruit juice. It is also seen in men and women who fail to use fruits and vegetables in their diets because of poverty or because they live alone and do not take the trouble to get an adequate diet.

In 1907 two Norwegian investigators were searching for the cause of beriberi. They found that guinea pigs fed a diet of grain and water only developed scurvy, but that this could be cured by feeding them greenstuff. This was one of those "lucky chances" in research because guinea pigs, monkeys, and man are practically the only creatures that must have vitamin C-containing foods supplied in their diet. Almost all other animals can synthesize this vitamin in their bodies. This discovery with guinea pigs opened the way for a quick and easy means of studying foods as a source of vitamin C. Finally, in 1932 an American scientist, Dr. C. G. King at the University of Pittsburgh, crystallized pure vitamin C from lemon juice. And at the same time, Dr. Szent Gyorgy in Hungary was making the same discovery using sweet red peppers. This vitamin is now named ascorbic acid and can be synthesized in the laboratory.

Pellagra

Pellagra is a disease somewhat more recently recognized than scurvy because it occurs mainly where people use corn (maize) as a staple of the diet, and corn was introduced into Europe after the discovery of the Western Hemisphere. Pellagra was described first by Gaspar Casál of Spain in 1735; he attributed it to faulty diet after observing its occurrence among poor peasants who lived chiefly on maize. The disease was common in Italy in the eighteenth century and continued to occur in that country until wheat and other foods were introduced into the high-maize diet. The Italians named the disease pellagra, meaning "rough skin," because this is one of the characteristics of the disease. In the nineteenth century pellagra was common in Roumania, Hungary, Turkey, Greece, and Egypt; it still exists where large amounts of cornmeal are eaten.

In the United States, pellagra was described first in 1907 by a physician at a mental institution in Alabama. It increased in the southern states among low-income families, both white and Negro, until in 1917 there were 170,000 cases recorded and many deaths. The United States Bureau of Public Health appointed Dr. Joseph Goldberger to investigate the cause of this malady. Many physicians thought it was an infectious disease, but Goldberger found that doctors and attendants in asylums where the disease frequently occurred were free from pellagra. Moreover, he was unable to transfer the disease from pellagrins to himself. He did not find pellagra wherever the diet included meat, milk, and eggs. All the evidence pointed to a poor diet, high in cornmeal, as the cause. By feeding experiments on animals and humans, Goldberger showed this to be true. It was first thought that something in good-quality protein foods such as meat, milk, and eggs prevented pellagra and that a pellagra-preventive vitamin would be found in these foods. Although this was not quite the answer, these proteins were found to contain an amino acid, tryptophan, which could be changed into the pellagra-preventive vitamin within the human body. The vitamin was discovered through studies with dogs which suffered from a disease called black tongue which is similar to pellagra in man. In 1937, Elvehjem of the University of Wisconsin found that nicotinic acid would cure black tongue in dogs. Clinicians then used this nicotinic acid on pellagra patients, and they were cured of the disease.

Rickets

Rickets is rarely seen today but was once a common disease of children in England and Europe. Bowed legs were the most visible signs of rickets, but many other parts of the bone structure also were affected. Rickets was most frequently observed at about the middle of the eighteenth century when the industrial revolution began in England and the rapidly increasing number of textile mills employed many women and children. Cities became crowded, slums developed, many families never saw sunlight, and rickets began to occur in children.

What was the cause of rickets? By some happy chance, cod liver oil was found to be beneficial. The Manchester Infirmary began using cod liver oil, fifty to sixty gallons annually, for treatment of rickets, joint diseases, and rheumatism. The oil took from four weeks to six months to have any effect. Many theories were given for the action of cod liver oil; some thought it was the iodine in the oil, others that it was the fatty acids. Not until 1922 was the answer found—a vitamin.

Where there is plenty of sunlight, there is no rickets. At the end of World War I, children in Vienna and Berlin were found to have severe rickets; they were treated by exposing them to lamps that produced ultraviolet rays, the same as those from sunlight. This process is called irradiation. Experiments with animals that were fed diets which produced rickets showed that it was just as effective to irradiate the food before giving it to the animals as to irradiate the animals. The puzzle was a complicated one. Rickets occurred where there was poor hygiene, crowded living conditions, and poor diet. Cod liver oil cured rickets and so did sunlight or the ultraviolet light from lamps. What could be the explanation?

In the 1920's, with knowledge of other vitamins as a guide, vitamin D was found in cod liver oil. Certain foods, and also the human skin, contain substances called sterols. When these sterols are exposed to sunlight or ultraviolet rays, one of the sterols is changed to active vitamin D. Thus two centuries of experience with the disease of rickets finally yielded the answer: vitamin D is necessary so that the body can use the minerals calcium and phosphorus to form normal bone. Today it is approved practice in the United States to give all infants some form of vitamin D such as irradiated sterol or the pure vitamin in solution. Infants and children are given milk to which vitamin D has been added. Thus another of the dietary-deficiency diseases has been eliminated for all who use the knowledge of nutrition.

Discovery of Vitamins

It was in 1906 that Frederick Gowland Hopkins, biochemist of Cambridge University, England, and Nobel Prize winner, reported that there was an unknown something in food essential for life and health. By 1912 he was able to support this statement with experimental data. He fed milk to young albino rats and they grew well. But when he fed them the purified constituents from milk, the animals not only failed to grow but soon died.

Another investigator, Casimir Funk, a Polish chemist working at the Lister Institute in London in 1911 was trying to find the substance present in the outer coating of rice which was known to be a cure for beriberi. His reading, thinking, and experimenting led him to believe that beriberi, scurvy, and rickets were all caused by something that was lacking in certain diets. These substances, present in certain foods, he named *vitamines* in a 1912 publication; this name was later changed to *vitamins.* Funk was not the first to propose that there was something in food essential for health, but he was the first to express clearly this idea so that it received attention in the scientific world. The name and idea of vitamins soon captured public interest.

The time was ripe for such an idea. But why had there been such a long delay in acceptance of the possibility of dietary deficiencies such as vitamins? It is not easy to explain why an idea presented at one time gains immediate acceptance and at another time is rejected or unnoticed for years or even centuries. In the second half of the nineteenth century, Louis Pasteur, the great French scientist, clearly demonstrated to all the world that diseases were caused by microorganisms. At the same time, Robert Koch of Germany identified many bacteria and showed how to fix and stain them for study under the microscope. Pasteur and Koch founded the science of bacteriology. In a world that had just awakened to the concept of disease caused by invading organisms or bacteria, it was not easy to accept an idea which was the complete reversal of this, namely that disease could be caused because something was *not* present.

Acceptance of the vitamin theory could not be delayed very long after 1912. Since 1907 Dr. Elmer V. McCollum and co-workers at the University of Wisconsin (and later at Baltimore) had been trying to find exactly what were the constituents of an adequate diet for cattle. The first interest of these investigators was to help farmers; only when the first vitamins were discovered did McCollum realize their significance for human health and become one of the great leaders of the day in human nutrition. McCollum and Marguerite Davis used synthetic diets, ones made up of purified materials. When lard was used as the source of fat in the diet, the experimental animals ceased to grow. But if fat from butter or fat extracted from egg yolk was used, growth was normal. Many experiments of this type led to a scientific report in 1913 telling that a special factor was present in some types of fat and not in others. Two years later, continued research provided evidence that there were two different factors essential for normal growth, one associated with fat and the other with milk sugar. McCollum called these factors "fat-soluble A" and "water-soluble B." McCollum also introduced the term "protective foods." This term clearly expressed the newly developing ideas of nutrition that foods differed in their value in the diet. In 1918 he wrote: "Milk and the leaves of plants are to be regarded as protective foods and should never be omitted from the diet."

At the same time that McCollum and Davis were making their first vitamin studies, similar investigations were being carried on independently by Osborne and Mendel at New Haven, Connecticut, and were in agreement with McCollum's findings. Thus, the first two vitamins, A and B, were proven to exist. Then many investigators in various countries took up the search for further information about these vitamins and for other vitamins. Soon vitamin C, the cure for scurvy, and then vitamin D, associated with the prevention of rickets, were described. Vitamin E, necessary for reproduction in animals, was added to the list in 1922.

By 1926 what had been called vitamin B was shown to consist of at least two separate factors. Although investigators did not know the chemical identity of these vitamins, they knew that they existed because of the effect on animals when foodstuffs containing these vitamins were withheld from the diet. Experiments were conducted using rats, mice, guinea pigs, monkeys, hamsters, chickens, pigeons, and farm animals. Studies with dogs led to the discovery of the vitamin that prevents pellagra. The physiological effect of the different vitamins, the comparative amounts of vitamins in different foods, and the effect of heat, cooking, drying, and other treatments on the vitamin content of foods were measured by feeding experiments. Search for other vitamins also continued. Microorganisms such as yeasts, molds, and bacteria were used because they too needed vitamins for their growth. Because the microorganisms grew much more quickly than animals, results could be obtained in a few days or hours instead of the weeks needed for animal studies.

The most recent vitamin to be discovered was vitamin B_{12}, or cyanocobalamin, which was identified in 1948 and found to be essential in the prevention of pernicious anemia.

While biological assays were going on in the animal laboratories, chemists were at work seeking to extract the vitamins from food, purify them, obtain the pure crystalline material, and determine the chemical formula for each. In 1926 a Dutch worker obtained crystals of vitamin B_1 which prevents beriberi. But it was not until 1936 that Robert R. Williams, who had spent a lifetime in the search for this vitamin, was able to produce it in quantity and determine its formula. The chemical structures of all the known vitamins now have been determined; they can be manufactured in the laboratory for use in research and medical treatment. However, the best way for every individual to obtain vitamins is from food. Meals that include meats, milk, fruits, vegetables, cereals, and butter or margarine can supply all the needed vitamins for the normal individual. Foods have the advantage of supplying not only vitamins but also the other essentials for health, namely calories, protein, and minerals.

NUTRITION IN MAN

Chemical analysis and feeding experiments have shown what nutrients are needed and in what quantities. But how to find out what goes on inside the human body was for a long time a puzzling question. How could one see inside man? Then in 1934 a new tool became available that made this possible, at least indirectly. Harold Urey, a chemist at Columbia University, discovered "heavy hydrogen," and for this he was awarded the Nobel Prize. Heavy hydrogen, now called deuterium, has all the properties and reactions of ordinary hydrogen except that it has a different weight or mass. This means that an atom of heavy hydrogen can always be identified wherever it is in food or the body tissues.

A young biochemist, Rudolph Schoenheimer, took some of the heavy hydrogen and placed it by chemical procedures in certain fatty acids and fed these to mice. After a period of this feeding the animals were killed and analyzed, and the amount and location of the heavy hydrogen were determined. In this way it was found that the heavy hydrogen had become part of the fat tissues of the body and even in those organs and areas that were believed to be fat-storage depots. This work introduced a new concept into nutrition—that there is a constant state of change within the cells of the body. There is a dynamic state in the body with constituents from food rapidly exchanging places with similar constituents already in the cells. This same type of experiment also was done with heavy nitrogen and the proteins. Many chemical changes were followed in the body by this method. It was as if a label were tied to nutrients in the food and they could be followed in their chemical processes throughout the body. Radioisotopes now serve the same purpose. These can be located in the body, its tissues, fluids, or bony structure, because of their radioactivity. Thus the biochemist has a new tool with which he can follow what is happening to food nutrients in the body; in other words, he can "see" inside man. Thus we have learned the answers, or some of them at least, to our earlier question of how food from the dinner plate is changed into Susie Jones.

Learning From Man's Eating Experience—Dietary Studies

In the last decades of the nineteenth century, careful studies were made of what different people ate. The reasoning was this: People who were able to work hard and appeared to be in good health must be eating the kind of food they needed. Therefore, food of such people was weighed and measured; the calories, total protein, fat, starches, and sugars also were calculated. Nothing was known then about vitamins or differences in protein; the calories were thought to be the all-important item. It is of interest that the caloric intakes calculated in these diet studies were almost the same as the caloric needs determined in the calorimeter studies done in Germany. Dietary studies were made for many groups in this country around 1900 by W. O. Atwater, "father of nutrition" in the United States. Atwater designed a bomb calorimeter, so called because of its shape. It was a tightly sealed container in which small weighed amounts of pure foodstuffs could be placed, ignited by an electric spark, and burned in oxygen. All the heat produced in this way by the oxidation of the food could be measured. Thus were obtained the familiar calorie values of food: four calories for each gram (about one-thirtieth of an ounce) of protein and of carbohydrate and nine calories per gram of fat. These calorie values of foods were used, and are still used today, to calculate the calorie value of a day's diet.

Dietary studies are currently used as a way of finding out if individuals are obtaining all the nutrients they need in desired amounts. The amounts of protein, fat, minerals, and each vitamin, as well as calories, are calculated. Dietary studies are a useful and practical tool in nutrition investigations.

Quantitative Requirements for Nutrients

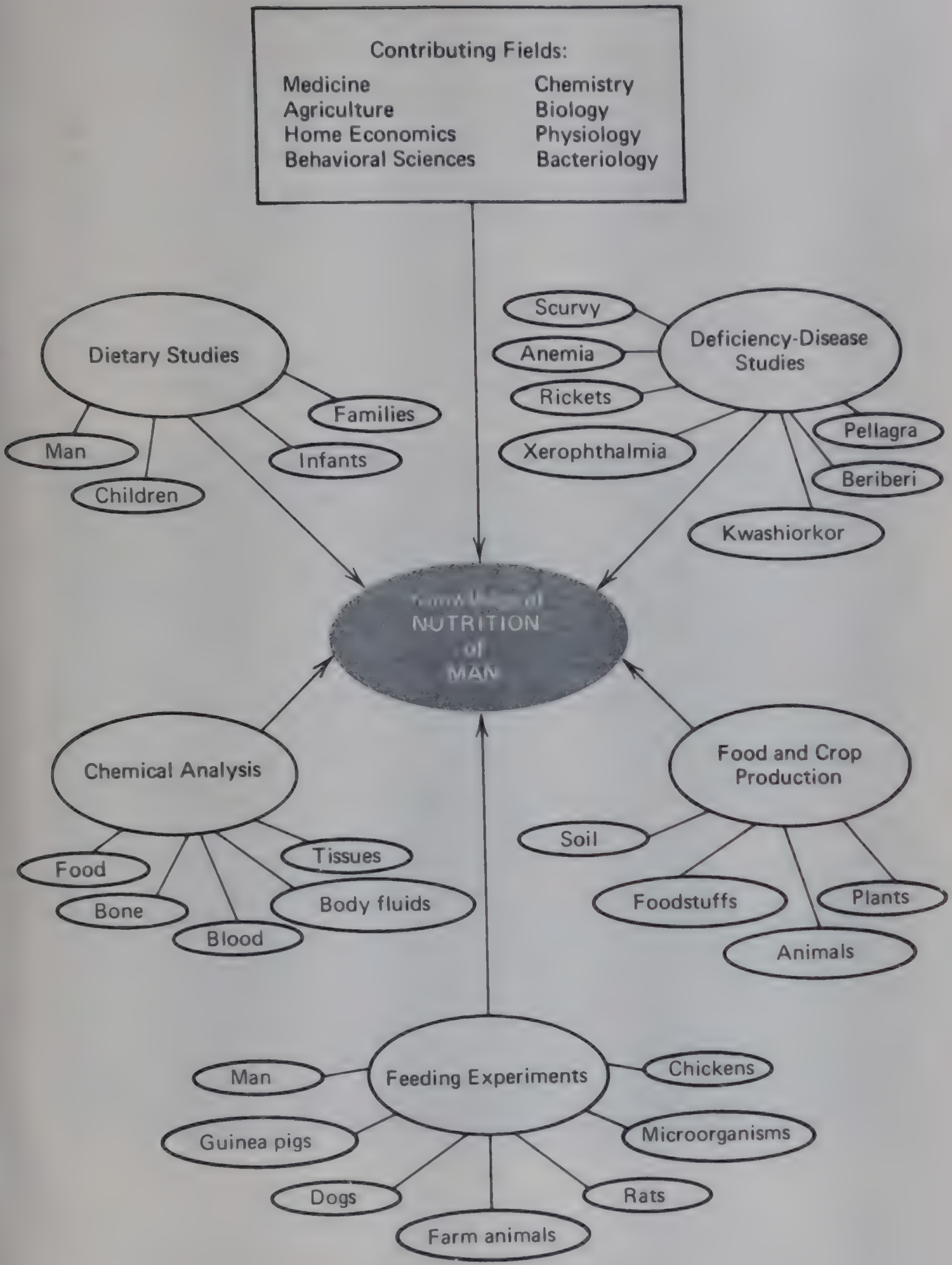
What are the constituents of food that are essential in the diet? This was one of the first questions that challenged investigators, but science is quantitative. How much of each nutrient is needed was the next question. This is more difficult to answer, and research still is going on to determine amounts needed of some of the vitamins and mineral elements. The basic principle is the same as that already described for animal feeding. Purified diets are used, and for the nutrient studied the amounts are varied to find how much is needed for growth and health of experimental animals. Then similar experiments are made on man. Here there are many difficulties encountered. Amounts of nutrients needed differ with age and rate of growth, with activity, body size, and a number of other influencing factors.

SUMMARY OF ACHIEVEMENTS IN NUTRITION

Man has progressed from food for survival to knowledge of nutrition for health. The four nutrition concepts given at the beginning of this chapter summarize in elementary terms where we stand today with regard to what we know of the science of nutrition.

Man's knowledge of nutrition as a science was negligible until the nineteenth century and has developed fully only in this century. Its growth has been dependent largely on chemistry, physiology, and medicine; nutrition had to wait for these sciences and the concept of the experimental method to develop. Also there had to be available the kind of laboratory apparatus and equipment necessary for quantitative measurements. Men, ideas, and tools at the right time and place have been the essential ingredients for progress and scientific discoveries. The figure is a graphic summary of some of the many and varied pathways that have led man to his present knowledge of the science of nutrition.

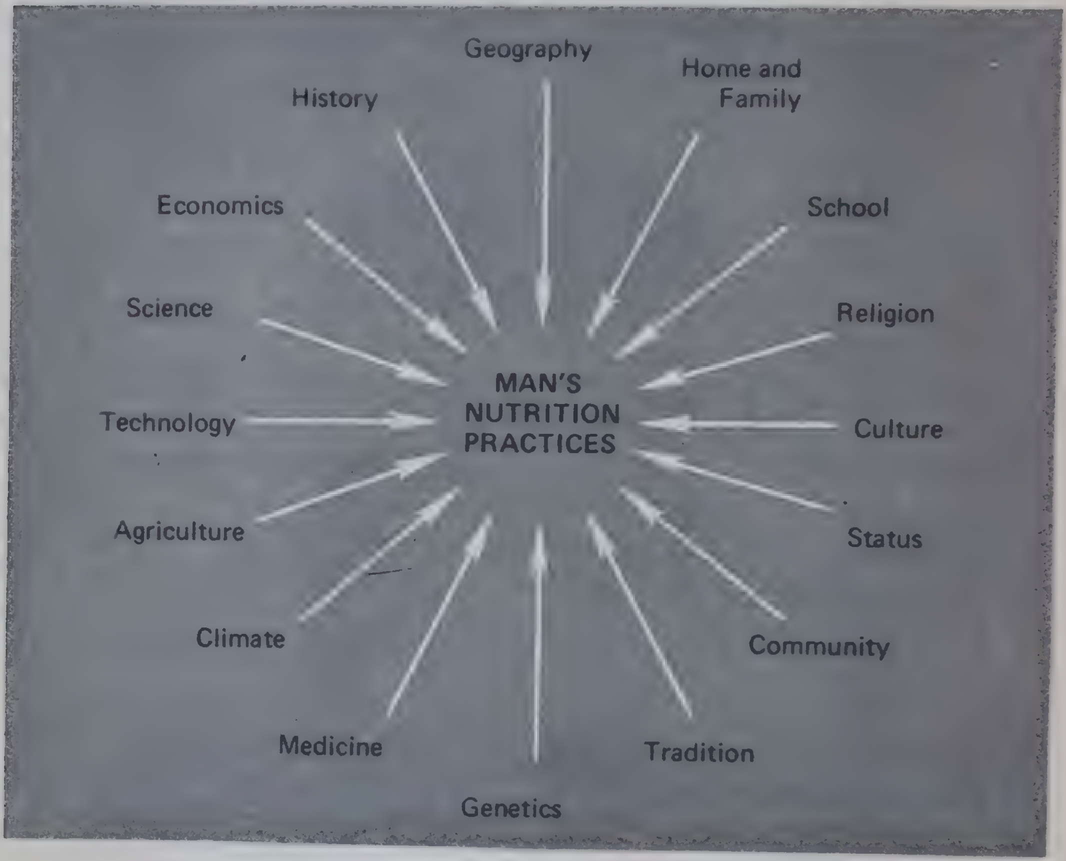
We now know that nutrition is essential for growth, health, and well being of all people. However, it must be added that nutrition alone cannot guarantee good health because many other factors are involved (hygiene, freedom from infection, accident, and other health hazards).


Contributing Fields:
Medicine
Agriculture
Home Economics
Behavioral Sciences
Chemistry
Biology
Physiology
Bacteriology
Dietary Studies
Man
Children
Infants
Families
Deficiency-Disease Studies
Scurvy
Anemia
Rickets
Xerophthalmia
Pellagra
Beriberi
Kwashiorkor
Knowledge of
NUTRITION
of
MAN
Chemical Analysis
Food
Bone
Blood
Body fluids
Tissues
Food and Crop Production
Soil
Foodstuffs
Animals
Plants
Feeding Experiments
Man
Guinea pigs
Dogs
Farm animals
Rats
Microorganisms
Chickens

Methods and areas of investigation that led to the development of the science of nutrition.

Progress in nutrition science is a continuing process, but there is an immediate challenge now. This challenge is how to make available to all people everywhere enough food of the right kind, and how to educate all people to select and enjoy foods for nutritive value.

The story of the history of nutrition shows how we have acquired our present sum of knowledge. Nutrition affects man's health, ability to work, behavior, and learning ability. But knowledge is not enough; man's use of knowledge is not always guided by his reasoning ability. Many other factors influence how and to what extent man uses his nutrition knowledge and what he practices in food selection for himself and his family. Some of these influencing factors are shown in the following diagram and will be discussed in succeeding chapters.


Geography
History
Home and Family
Economics
School
Science
Religion
MAN'S NUTRITION PRACTICES
Technology
Culture
Agriculture
Status
Climate
Community
Medicine
Tradition
Genetics

STUDY QUESTIONS

1. In the nineteenth century, chemical analysis could not measure all the nutrients present in food. Why was this and how was the problem solved?

2. This chapter has stressed some problems encountered in the development of nutrition science. Can you list these and others you find in your reading? Can you explain why these were major problems at that period?
3. Men of the past were seeking for the unknowns about food values and nutrients in relation to health. What can you envision as unknowns in this field that should be explored today?
4. Read the journals of some early explorer of land or sea or the diaries of early American colonists. How would you evaluate their food and its nutritional value?
5. What were the chief nutritional problems at different periods in American history such as the early colonial days, the overland trail period, the industrial expansion era, and the growth period of large cities?
6. Prepare a chronological chart showing major discoveries in nutrition and other events happening at that time. What are the relationships between nutrition progress and other historical events?

TOPICS FOR INDIVIDUAL INVESTIGATION

1. Describe your concept of man and how much he can or should be influenced by nutrition. Develop in depth your concept of a well-nourished individual.

2. In what ways does the history of nutrition help you understand other events in history? Choose one of these events and develop the relationship.

3. Choose one of the nutrients and critically trace its history of discovery; or choose one of the discoverers in nutrition science and describe and evaluate his work in relation to his life and personality.

4. Polar explorations have failed many times because of nutritional difficulties. Select a polar expedition, describe its preparations and route, and then evaluate the nutritional problems, why they occurred, and whether or not they were inevitable at that time.

5. In what ways has the stage of nutrition knowledge influenced the outcome of wars or exloration? Choose one of these events and trace the relationship between the event and nutrition.

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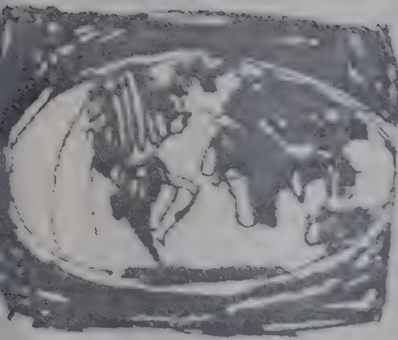


FOOD IN HISTORICAL PERSPECTIVE

PREHISTORIC TIMES

Prehistoric man was a food gatherer; he spent nearly all of his life in the search for food. He was primarily a red meat eater. It is easy to understand why he showed such a strong preference for meat—he had to. Certainly prehistoric man who dwelt in the Northern Hemisphere during the long ice age and its interglacial period had to rely on meat because vegetation and grain did not grow on frozen soil. It is also easy to understand why he favored the larger animals in the hunt because they ensured a longer food supply. Since this meat supply was stored in caves, the latter were generally littered with bones and debris. It is fortunate that good housekeeping was not then of importance, because much of our knowledge of prehistoric man and his food has been obtained from the fossil animal remains found in his caves.

The fossils and relics indicate that primeval man increased both in stature and brain power as time went on. It is logical to assume that an increased food supply had something to do with his increased stature and perhaps even his increased brain power. Primeval man had always utilized nature to some degree. As his brain power increased, his control increased, but even in the case of homo sapiens, this control was primitive and haphazard.

Eating in a group apparently afforded primeval man much pleasure. To provide a feast brought him prestige. Food was something to be shared by his group or tribe, as were the hunting grounds or the hunt itself. When the hunt was good and meat was abundant, he gorged himself, sought relief, and gorged himself again. No thought was given to the morrow. When food was plentiful and if he felt the urge, prompted by such motives as witchcraft or religion, food was destroyed. This was the way of most primeval people.

Periodically when the population increased, food became scarce; want took over. Hunger forced man to invent traps and snares for the lowly beasts and to fall back on the grass-covered pit to capture an elephant or other large animal. In times of hunger, man killed and ate everything he could catch whether it walked, crawled, climbed, flew, or swam. Even his domestic animals and pets were not spared. It is a distressing fact of history that all races from the beginning have been cannibals.

Homo Sapiens

Although it is not definitely known when homo sapiens appeared on the scene, best opinion holds that it was some sixty thousand years ago or near the end of the ice age. The early culture of homo sapiens was a culture of three epochs. In the earliest of these epochs the tribal peoples killed and ate the mammoth and rhinoceros. In the second epoch, they killed the mammoth but ate only the most edible parts such as the tender muscles, the liver, and the brain. The food of the latest of these peoples was almost entirely animal fare such as the reindeer and the horse but fish was now included. Plants too may have formed part of their diet since the drawings in their caves indicate an interest in plants. Both grain and flour date back at least twenty thousand years or well into the epoch of homo sapiens. And it is almost certain that millet in Eurasia and maize in America were available about that time.

Change in Climate

On or about 8000 B.C. the climate was showing signs of a change to something warmer. The glacial period was coming to an end. In Europe the greatest effect of this change in climate was a gradual reforestation of the tundra. Some herbivorous animals became extinct. The extension of the forests not only reduced grazing but also sheltered the carnivorous enemies.

European Man

Up to about 5000 B.C. the people of Europe were still food gatherers. But because of the disappearance or migration of many tundra animals, they were no longer primarily red meat eaters. Warming of the northern waters fostered an abundance of fish. Water fowl, eggs, sea foods, hares, slugs, snails, snakes, roots, berries, nuts, and plants were now available. However, deer, wild cattle, and boar still abounded and were to be hunted.

Man of the Near East

At the end of the ice age, aridity forced men and animals of the Near East to gather around lake, river, and sea. Suddenly, at about 8000 B.C., came one of the greatest of man's discoveries: that seeds dropped in the ground can yield a harvest a few months later. Agriculture in the form of mixed farming soon followed. Man of the Near East had made the initial change from a *food gatherer* to a *food producer*. Man in Europe followed and also became a food producer. This happening might well have been the beginning of civilization.

Prehistoric Man's Contributions

Modern man has not added many domesticated animals and not very many new vegetables to those known in late food-gathering times. Most of the new vegetables that we have were developed from the herbs of food-gathering times. Most of the old world fruits were known to prehistoric man. It is apparent then that most of our foods of today are his contributions because he selected them in the first place. Fortunately there is an infinite variety of foods that fit our needs, and primitive man appears to have used them all. He was the experimental animal in the testing of food, and he learned by trial and error to avoid poisonous plants. When he erred he paid by sickness and frequently by death. No doubt he used other animals in many cases as guinea pigs, and he probably discovered methods and tests to lessen his risks. Those who survived the early experimentation found a more or less satisfactory pattern of food consumption for their area which enabled them to live and which has been to our advantage. Because of this early re-

Grain—the world's chief food throughout history. (Courtesy of Food and Agriculture Organization)

search, if for no other reason, we should salute *prehistoric man—the food gatherer.*

ANCIENT TIMES

Our interest now turns to the period of time starting with the beginnings of agriculture between 8000 and 7000 B.C. and ending with the downfall of the Roman Empire in 476 A.D.

The Beginnings of Agriculture

Market gardening was practiced on the shores of the Caspian Sea at about 6000 B.C. or at least a thousand years earlier than at any other place on earth. Gardens next were cultivated in the Iranian Plateau (Persia). Other food-producing communities were building up from the Indus River to the Nile delta. The pattern of the Fertile Crescent* was beginning to develop.

Civilization depends upon man's ability to produce food efficiently.

*Begins with Egypt and extends through Palestine, Syria, Mesopotamia, and hence eastward to the Indus River.

Bread—a universal food. (Photograph by Philip Gendreau)

Thus the great civilizations of Mesopotamia and Egypt did not emerge until food production methods were planned and developed. In this epoch irrigation by means of canals was the catalyst that stimulated the production in Eastern Asia of cereals and livestock, both so essential to our civilization.

Cereals

Cereals were the first products of the Fertile Crescent. The first grains grown were wheat and barley. Rye, rice, and oats were cultivated later. The grains which were liked by civilized man were those which pleased the taste and which were the most rewarding to produce. Seven species have helped feed man for up to ten thousand years—wheat, rice, barley, oats, and millet since prehistoric days, rye since the classic time of Rome and Greece, and maize since the discovery of America.

Bread

FLAT BREAD—Postglacial man roasted his grain on hot stones and then mixed it with water to form a paste. Sometimes he heated this porridge over hot coals and baked it to a tough sheet. Barley flat breads and porridge were the main cereal foods of many peoples for many centuries before the discovery of leavened bread. If barley or some other grain was not available, breads were made of flour ground from acorns or other nuts.

RAISED BREAD—Bread dough was first allowed to sour or ferment by the Egyptians. They found that when they baked their sour dough in the oven the resulting product was better than any bread they had known. Thus it happened, perhaps by accident, that raised bread was discovered sometime between 5000 and 4000 B.C. After the discovery of raised wheat bread, barley fell off in importance, particularly since barley bread did not rise or bake suitably.

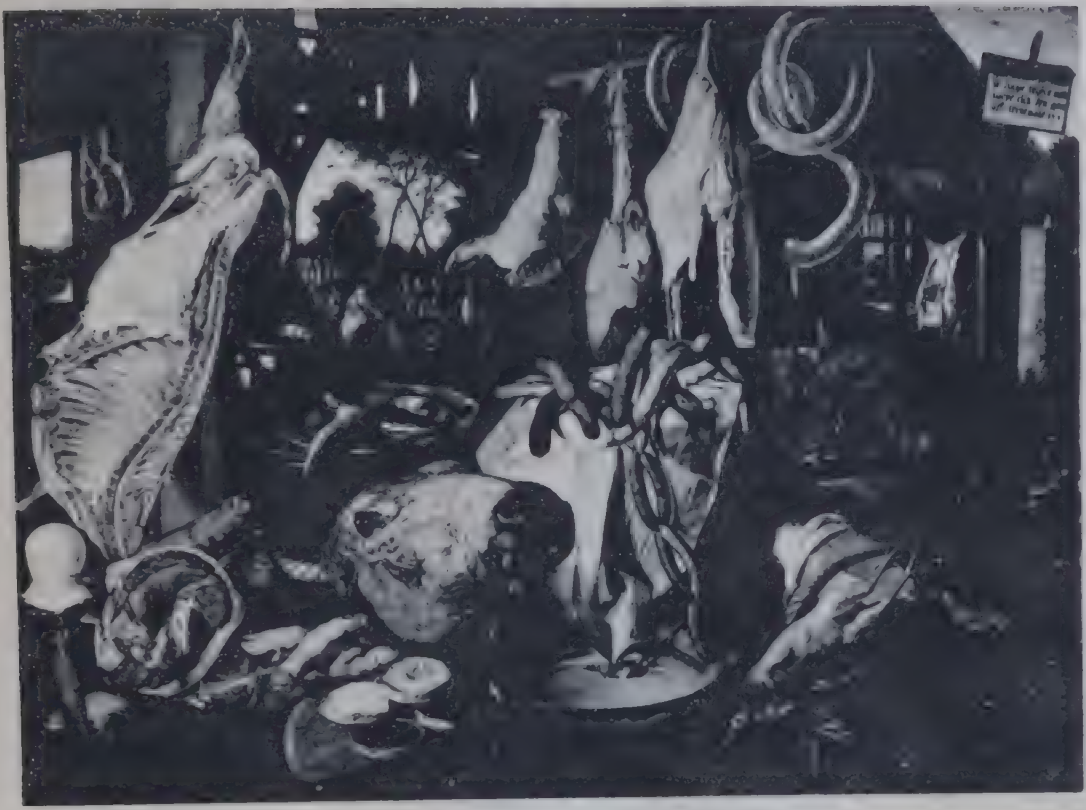
For all ancient people, the cultivation of wheat was a major step forward. Wheat could be ground and stored for use when meat and vegetables were not available. A second step forward in the economics of food was made when the Pharaoh took Joseph's advice and set aside some of the grain harvests for the lean years to come. By this counsel society was taught to save—so necessary for the accumulation of capital with its subsequent rewarding productivity.

Meat

Livestock farming is one of the material foundations of civilization. It is of nearly equal importance to cereal production. Meat has the advantages of flavor and food value, but cereals are cheaper and are high-calorie products. Man may like meat, but when food is short and land scarce for pasture, he can and must exist on a cereal diet.

Meat has been eaten by practically every human group at some time. Post-glacial man was acquainted with all our present day farm animals. Cattle, sheep, goats, camels, reindeer, asses, pigs, and horses, as well as cats and dogs, were domesticated by him. The domestication of goats probably took place eight to nine thousand years ago, and of cattle, sheep, and pigs not long after. Most of our poultry was domesticated in early food-producing times.

CATTLE—Domestication of cattle is believed to have begun between 4000 and 3000 B.C. on the lush hills of Palestine, Lebanon, and Zagros. To raise cattle, good and sufficient pasturage, a temperate climate, and sufficient labor are required. Few, if any, of the farms in the ancient world complied with these requirements; consequently meat generally



The types of meat have not varied through the ages. "The Meat Stall" painted by Pieter Aertsen. (Courtesy of Marburg-Art Reference Bureau)

was scarce in the ancient world. Cattle raising was impractical unless the animals could be raised without consuming food that starving men could use. In the fall of the year when the pasturage ran out, the first duty of the farmer was to slaughter and salt down the animals that could not be fed over the winter. Salting and smoking techniques were well established by 1000 B.C.

SWINE—By far the most practical animal in ancient as well as medieval times was the pig. The spring pig could seek its own food most of the year. In the fall it was marketed. The Gauls were great lovers of pork and their principal trade with the Romans was in hams and salt pork. Their homelands, now France and part of Germany, were covered with immense forests of oak. These forests were choice areas for raising pigs. The acorns of the oak forest fed the swine and in turn the Gauls.

SHEEP—Sheep were domesticated in Southwestern Asia, Asia Minor, and Egypt in early food-producing times. They were brought to Spain by the Phoenicians. Sheep raising became the chief economic enterprise of Spain when it was part of the Roman Empire.

Primitive food preparation. (Photograph by Philip Gendreau)

POULTRY—The hen, from the jungles of India, was introduced into Europe about 600 B.C. where it was used for food and egg production. The production of eggs subsequently became very popular in Rome.

Dairy Products

In the areas where cattle production was at a low level, and this was general in the Northern Hemisphere, scarcity of milk and its products necessarily followed. Milk was thus available in such areas only on the farm or in the adjacent local community. Since milk and butter were poor travellers, only cheese was an item of trade. Cheese was first developed about 3000 B.C. after Arab horsemen found that the milk in their goatskin saddlebags had turned to a soft curd. The Arabs introduced cheese to Europe about 2000 B.C. Butter rarely is referred to by ancient historians and then only as an ointment.

The Egyptians, Greeks, and Romans rarely drank milk but they did make cheese. Other Europeans drank the milk of the cow, ewe, and goat. The Tartars and Mongols drank mare's milk. The milk of all ungulates was used for food by one or more of the ancient races.

Miscellaneous Foods

With the exception of potatoes, maize, lima beans, squash, tomatoes, and chocolate, all of which came from America, most of our present market vegetables such as cucumbers, egg plant, lettuce, onions, peas, and turnips had their counterparts in the gardens of the Fertile Crescent. Fruits available in some stages of development included apricots, berries, dates, figs, grapes, lemons, melons, and pomegranates; some historians also include apples, cherries, and pears. Nuts indigenous to the time were almonds, pistachios, and walnuts.

The Foods of Ancient Peoples

"The histories of mankind which we possess are in general histories of the higher classes," wrote Thomas Robert Malthus. Since the chronologists of ancient and medieval times were no doubt in the employ of kings and rulers and, therefore, oriented to write what their masters would enjoy and appreciate, the statement of Malthus has a ring of truth and honesty. If the histories of mankind from the chronologies of ancient and medieval times portray a better life than existed for the average man, then the life of man in the lower strata must have been bleak indeed. What is needed is a knowledge of the work-a-day man of the previous ages, his everyday life, his trials and his pleasures, and as far as food is concerned his likes and even his hunger. The modern historian has endeavoured to present such facts honestly.

Egypt

Civilization came to the valley of the Nide some six to seven thousand years ago. To the Egyptian the Nile personified the father of the family who fed and clothed his children. Every June the Nile slowly overflowed its banks, irrigated and enriched its wide stretches of fertile land, and then receded just as slowly by late October. Neolithic settlements close to the Nile Valley give evidence that these predynastic people cultivated wheat and barley, hunted game, fished, and raised a few domestic animals for meat. Stock raising could not be greatly encouraged because of the numerous great carnivors of the cat family. Fish and poultry were plentiful. The ancient Nile peoples were fond of eggs of all kinds—hen eggs, turtle and crocodile eggs, lizard and ostrich eggs. Cabbage was in particular favor with the later Egyptian upper classes, and locusts were considered by them as exotic foods. Mushrooms were cultivated for the Pharaohs. Beer made from barley was consumed in great quantities. For the common people the preferred foods were bread and oil, but they also liked leeks and onions.

Essentially, however, the Egyptian was a lover of wheat and bread. To refuse bread to anyone was a great offense; bread was even left in the tombs. Wages were paid in bread and taxes were collected in grain. Bakers in Egyptian society were as well regarded as priests, and their baking furnaces were built in the temples. Commerce in the Mediterranean was active; Egyptian wheat was exchanged for the dried fish, dried fruit, and cheese of Asia Minor.

Israel

The basic foods of the Jewish people were much the same as their contemporaries and neighbors. In accordance with their dietary laws, however, certain foods were forbidden (see Chapter 4). Different too was the preparation of their foods. Meat was available chiefly at festivals after animal sacrifices. On special occasions, wheat and barley were cooked with lamb or mutton. Game was much sought after. Chickens were very scarce and expensive but pigeons were cheap. Nuts were favorite foods with the affluent. A surprising form of food was the locust.

The common people ate bread and fish frequently; fish was more important than meat to them. Many vegetables also were included in their diet; beans, lentils, cucumbers, and onions were favored but herbs and greens were not overlooked. Palestine produced a very fine red wine. This drink was part of the religious scheme of the Jewish world. There should be "wine for the afflicted heart," says the Proverbs (Proverbs 31:6:7).

India

In the valley of the Indus the same progress in the production of food was made as in the Nile and Tigris-Euphrates valleys. Rice and wheat were the staples of the diet. In the earliest settlements of postglacial India, wheat, barley, and dates were cultivated. Rice is said to have originated both in India and China at about 1800 B.C.

Sugar cane was an early product of postglacial India, as were many native fruits that grew well. Fruits such as grapes, peaches, pears, plums, oranges, and mulberries were preserved with sugar and traded to the Arabs for spices. Native mustard and ginger also added flavor to the Indian meat.

Long before the time of Buddha, the Hindus raised cattle for domestic consumption. Other animal fare included the antelope, pig, dog, buffalo, sheep, and above all the hen. The world is indebted to India for poultry. The cow has been held sacred in India since 1000 B.C., and vegetarianism has been a symbol of the Hindu faith since the time of Buddha (563 B.C.–483 B.C.).

China

The civilization of China appears Mongolian although some historians claim it had earlier roots and was later Mongolized. Rice was the staple article of diet, but millet was the only grain available in some parts of China and the neighbouring Asiatic countries. Millet can be cultivated under conditions adverse to wheat, barley, or rice. It withstands both drought and high humidity very well during the growing season.

The food habits of the Chinese as compared to those of their neighbors were opposites as far as dairy products were concerned. The Chinese considered milk unfit for human food. The Mongols on the North and the Tibetans on the West used milk and milk products from time immemorial. The reason, no doubt, stems from the fact that China is so very densely populated; food is in short supply because space is limited. Under such conditions the cow is a luxury and the pig is the only practical food animal to raise. Both Mongolia and Tibet have excess land on which to raise milk-producing animals.

The post-glacial agricultural revolution in China appeared before 2000 B.C. in the valley of the Yellow River where cattle breeding was practiced and cereals grown. By 1940 B.C., pigs, cattle, sheep, goats, chickens, and ducks were being raised as well as water buffaloes. Food never has been plentiful in China.

Greece

In early Anatolian Greece, the economy was dependent on cattle and agriculture. Although the Greek soil was not well suited to agriculture, it was well fitted for the cultivation of olives and vines. The Greeks produced excellent wines which were much in demand in nearby Asia. Foreign trade with Mediterranean countries flourished. Ancient Greece became prosperous because of her industries of olive oil and wine.

The social structure also was affected by these industries. A new aristocracy of the owners of the olive groves and the vineyards was created, supplementing that of the land owners. The cultivation of cereal crops was given up by the land owners who then turned their efforts to olive groves and vineyards. Slaves were needed to work in the vineyards and to row the galleys carrying the wine and olive oil in seaborn trade.

As the population of the cities grew, it became more and more difficult to obtain a sufficient food supply. Grain was especially needed. New shores along the coasts of the Black Sea and Italy, particularly Sicily, were colonized, chiefly to supplement the production of grain and fish. Much of the food of ancient Greece was imported.

The Athenian of the post-glacial period was largely a vegetarian and a man of moderate diet. Beans, cabbage, leeks, lentils, onions, and turnips made up his diet. He was especially fond of pea soup. Although meat was generally scarce—the herds were too small to support the population—it was available to the affluent classes. They chose a typical dinner from ham, lamb, or deer; salt fish, eels, and fowl were also available. Breads of many kinds, fruit, wine, and vegetables marinated in olive oil and honey rounded out the meal. The poorer Athenian ate wheat and barley porridge with honey, olives, fruit, and vegetables. "We must train the whole man by gymnasia and diets," said the Greeks, and so they did for centuries.

As mentioned, ancient Greece was dependent upon imported foodstuffs. A loss of export markets necessarily resulted in a reduction of the importation of essential foods. The decline of Athens after 350 B.C. was associated closely with shortages of foodstuffs. Thereafter Grecian meals for all were drab. Cooked cereal with figs, dried dates or olives, and cheese comprised the common diet. Occasionally meat was served, especially at festivals after the sacrifice of animals. Turnips and onions were the vegetables available most frequently. Some fresh fish usually was available in summer, but in winter salt fish only could be had. However, the lasting permanent food of the Greeks was bread with oil, wine, and honey. Without wheat, the Greeks faced hunger. The full production of the soil, netting a scant seven to eight bushels to the acre, was necessary if they were not to go hungry.

Rome

The ancient world of Rome and her provinces was basically a world of hard labor and want. Bread, wine, and oil were staples in Rome as in other countries of the Mediterranean. The Mediterranean Basin did not become a big producer of wheat with the dawn of civilization, but it always produced olive oil. In the early days the only animal ever eaten was the pig, perhaps because other meat was too expensive. This pattern also has been attributed by some to a racial dislike of meat.

The food habits of the upper classes of Rome and her commercial cities changed greatly when almost every known food was made available through importation. A diet of vegetables then came to be despised by the upper classes of Rome. They preferred instead a dinner consisting of several dishes of meat, chicken, sausage or bacon, fish and eggs, a variety of green vegetables, olives, chestnuts, and a wide variety of fruit. Cereal also was included.

For centuries the chief food of the average Roman was porridge and roasted grain. Extras were in the form of ham and salt pork from Gaul and fish, usually salted, from the Mediterranean. Vegetables usually were either dried or pickled.

It took the Romans a long time to learn that raised bread was better than roasted grain. But once convinced, they respected bread and cherished it. Breadmaking in Rome became a highly skilled craft. The bakers established guilds whose rights were guaranteed by the state. The Emperors bestowed special favors on the bakers who were made state officials. This was a corrupting development, good neither for the bakers nor for the people. As Plutarch said, "The person who first begins to give largesse to the people is he that deprives them of their power."

Bread made the Roman Empire great, but bread also contributed to its destruction. Pliny explained this situation in a few words: "The great land holdings have destroyed Italy and the whole Empire." The rulers of the Empire enforced a land policy that proved ruinous. Veterans of the Roman wars who were granted land for service abroad, as well as the other small land owners, found themselves unable to support the slave labor needed for cultivation and also face the tax collector who demanded wheat, barley, wine, and other agricultural products. The small land owners therefore were forced to sell their land to the few who were able to buy; it was not long before all the land of Italy belonged to a few hundred families. The few grew richer as the middle classes were impoverished and degraded and the poor lived in absolute misery.

The family land owners soon found it more profitable to use their vast land holdings as great pastures than for grain production. They sold grain, but it was brought to Italy in ships from Rome's grain-growing overseas possessions: Spain, North Africa, Egypt, and even England.

When the wild tribes of the Sahara in the time of Nero crossed the Straits to Spain, they stopped the export from Spain of about one quarter of Rome's total grain requirements. In 429 A.D., nearly four centuries later, the Vandals crossed the Straits from Spain to Africa and took possession from Rome of the wheat lands that had been developed there. It was the end of the wheat lands; today they are still deserts.

So long as wheat could be obtained from Egypt, Rome did not want for bread because the Empire controlled the richest of wheat lands. They who controlled the supply and transportation of wheat also could dictate. It was this kind of thinking that actuated the revolt of 69 A.D.

when Flavius Vespasian seized the Roman grain fleet. By this ruthless scheme, the Flavian family took power in Rome. It was the Flavians who later made the bakers civil servants and bakeries "Places of State." Politics was in the ascendancy.

Roman land policy which allowed pasturage by the few land owners created vast unemployment among the farmhands who then flocked to the city. Slowly but surely, unemployment became the terror of the Roman treasury. Oil, wine, and bread were dispensed to the unemployed masses. By a decree of the Emperor, the right to receive the dole of free bread from the "Places of State" had become hereditary. Thus the unemployed were encouraged to multiply for they and their descendants would be forever maintained by the state. And all the time the bread lands of the Empire were plundered to send food to Italy, but in these provinces great numbers suffered hunger. The Roman Empire now was facing destruction accelerated by a complete breakdown in the food supply engendered by bread politics.

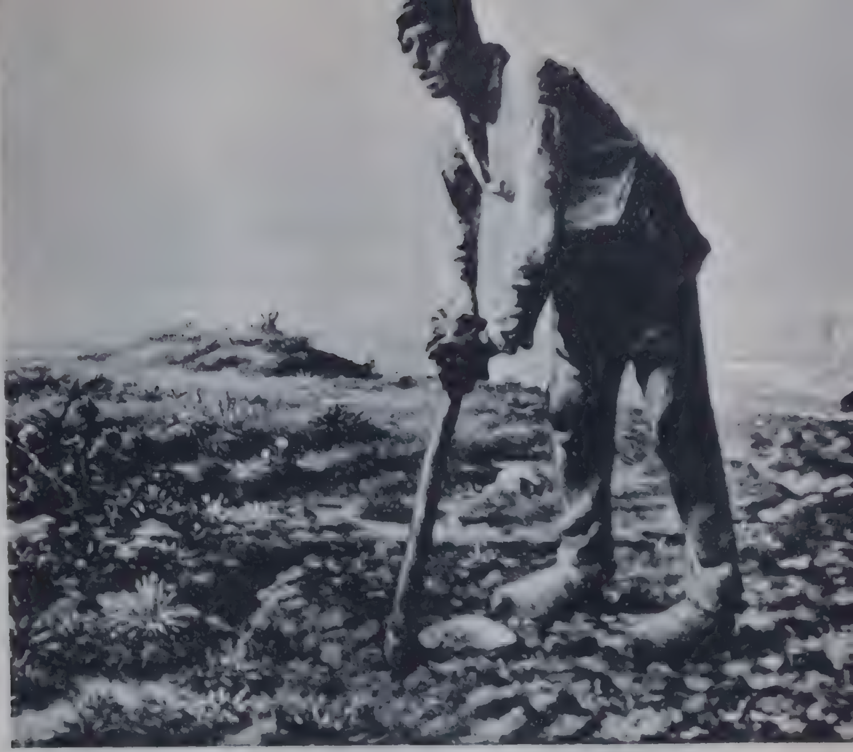
The final downfall of the great Roman Empire due to the repeated onslaughts of the Germanic tribes from the North left this ancient period with few lasting material accomplishments to its credit. Progress in ancient times was rare, and periods of progress were followed by stagnation. Man's full activity and initiative cannot be maintained for long by porridge and breads alone. The decadence of ancient civilization was due largely to the inadequacy of man's tools to supply the necessities of life. Food has never been available without work nor abundant food without machines.

THE MIDDLE AGES

The Roman Empire

In the beginning of the fourth century after Christ, the ruling upper class Romans had become attached to a life of pleasure, luxury, and sensual gratification. A guest at a feast might be served a roasted young boar or a whole goose along with a whole fish. Delicacies such as peacock's tongues as well as sweet meats, bacon, breads, honey, and fruit also were included. These feasts lasted for several days. Imperial Rome had become soft. The Romans were in no frame of mind to cope with the hardships and problems of conquest nor with the administration of lands which their conquest might bring them. In contrast, their neighbors, especially those on the northern frontier, had become stronger, harder, and more confident. The frontiers of the Empire were under continuous attack from these raiding German barbarians.

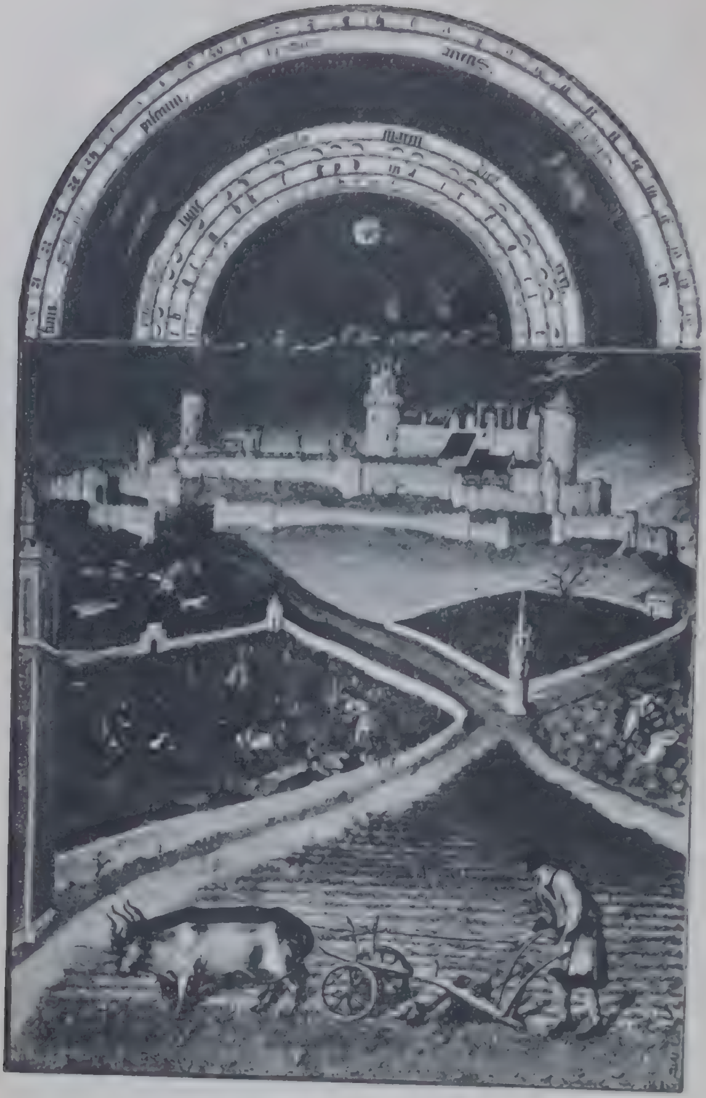
The eternal struggle to produce food. "The Man with the Hoe" painted by Jean Francois Millet. (Courtesy of Marburg-Art Reference Bureau)



The administration of the vast Roman provinces had become difficult and expensive. The peoples of the provinces, long deprived of thinking for themselves, looked to Rome for guidance. They wanted Rome to defend them against the menacing invaders. But the Romans suggested that each province should provide its own defenses and its own grain. To implement this policy, early in the fourth century, the Roman Empire was divided into an eastern half with the capital at Constantinople and a western half with the capital at Rome. It was hoped that this start on the proposed new political organization would firm the will of the provinces toward an increased war effort against the northern enemy. The immediate effect was the sudden appearance of two more empires, one in the north and one in Africa. The provinces concerned separated reluctantly from their mother country. But Rome could not give them protection, and the provinces could not provide Rome with any grain. The northern provinces had already suffered so much from the fierce barbarians that they were hard put to feed themselves. So the provinces were determined to control their own grain supply which meant separation from Rome.

Agriculture

Before the northern tribes took possession of Roman land, they knew nothing about slavery. They killed their prisoners. In Roman agriculture, slave labor had long been the custom. The worker was shackled to the soil. Because the Teutonic tribesman disliked hard labor and agriculture, he made the descendants of the enslaved Roman colonists



Agriculture in the middle ages. Painting from "Les Tres Riches Heures du Duc de Berry." (Courtesy of World Health Organization)

serfs, attached to the land. The tilling of the soil was performed by these serfs.

Through the whole cycle of cereal agriculture, paganism and christianity engaged in an emotional battle for the control of the farm land. The barbarians considered cultivation of the soil sinful and wanted to leave everything to Nature. The monks refused to do this. The Romans possessed at this time great agricultural knowledge. Crop rotation, irrigation, and the use of hand tools and fertilizer were well known to them. But it was difficult for the monks to impart such knowledge to men with whom they were unable to converse. Ignorance in agriculture was fostered by the loss of Latin as the language of the people. Agricultural literature was written in Latin. Without the efforts of the monks, the results of medieval agriculture would have been still more disastrous than they were.

In the Middle Ages, all land owners from the lord of the manor and the abbot of the monastery to the small free peasant had to follow a system of common cultivation. They had to plow, sow, and reap at specified times. Rye was the cereal grown in northern and western Europe. It was the hardiest of all cereals and was favored by the German tribes who had lived in a land of sterile soil. Crops, other than rye, might have been raised to advantage, but no new crop could be introduced into an open field farm unless all the farmers agreed to change the field system. This agreement was never possible. So bread of the Middle Ages was made from rye.

The Middle Ages practiced what the modern world would term community planning on the farm. The profit motive had been successfully eliminated, and the result was frequent periods of hunger, especially for the peasantry.

In the year 943 A.D., the major food disaster of all time, a disaster of diseased grain, occurred in Limoges, Gaul. The disease known as ergotism was caused by a fungus disease of rye, ergot, which turns the grain black and sweet tasting. The events were more terrifying than anything that had even been seen before. Shrieking, writhing men collapsed with convulsions or rotting limbs. Forty thousand people died in one year. Only the Romans had knowledge of ergot poisoning, and their literature in Latin cautioned against eating rye so infected.

There were some bright spots in agriculture during the Middle Ages. The first forward movement was made from the fifth to the eleventh century by the Saracens in Southern Spain—a period of market gardening. There is hardly a civilized country in the world which has not benefited by the agriculture of Moorish Spain over eleven hundred years ago! It should be noted that the subjects of the Moors in Spain had enjoyed a degree of independence by reason of the policy of their rulers.

From the tenth to the fifteenth century the best of agriculture in Europe moved from Spain to Northern Italy and thereafter to the Netherlands. The Po Valley with its broad fertile plains in Lombardy, the garden of Italy, carried the lamp of civilization during the darkest periods of the Middle Ages.

The Common Diet

As in all ages bread was the standby and a favorite food of all. When the grain failed, people starved. This fact was particularly true of the Middle Ages. The rye crop often failed due to poor agricultural methods, wars, drought, or disease. So the story of food in the Middle Ages in some instances is not a very happy one.

Vegetables were scarce or absent from the diet during this period.

Leeks, onions, and cucumbers were the exception. Cauliflower, carrots, parsnips, turnips, and beets were grown in the gardens of castles and monasteries but they formed a small part of the diet of the poor. Mushrooms were plentiful and were used in stews. Herbs were used for flavoring and honey for sweetening the diet. A serf of the eighth century produced his own wine and raised pigs, calves, chickens, and eggs on his plot of land. Wild game occasionally appeared on his table. From his feudal landloard he received token amounts of rye bread and sausage. Fruit rarely, if ever, appeared on the serf's table—he could not afford this luxury.

Fuedal barons dined on a variety of meats—mammoth roasts, wild boar, venison, veal, game, ducks, geese, and chicken. Fish was eaten if the barons lived near a sea, lake, or river. Bread, cheese, fruit, and honey always were available. They were fond of beer and wine as beverages.

The meat, cheese, and bread diet was somewhat monotonous. But it was not until the sixteenth century that the market gardens about London remedied the scarcity of vegetables in that area.

Etiquette and cookery improved somewhat in the thirteenth century. But in England at that time, there were public protests about rotten sausage made from measly pigs. No wonder spices were eagerly sought after. Salt and spices were sold at the market place. Hams, bacon, sausages, salted beef, and bread dominated the English diet. In Paris the poor did not even have pork to eat. They searched the city for edible garbage.

Hunger

Hunger has always existed. But famine always has been limited in time and area. In the Middle Ages this limited appearance of famine changed. For the first time, hunger appeared everywhere and as something permanent—first here, then there, and frequently making the rounds again. In the Middle Ages, people lived upon what they grew in their own land. The peasant never had any surplus to tide him over a lean harvest and he had no technical knowledge of agriculture nor of the soil. He would have been astonished to know that the soil could be helped to produce.

Hunger in the Middle Ages was not always caused by a failure of the crop due to poor agriculture. War was frequently the underlying cause. Wars were so frequent in Western Europe during the first twelve centuries after Christ that they became part of life. It was not until the end of the Dark Ages, around 1100 A.D., that this warfare subsided.

When famines came the people of France remembered the acorn. Before men knew grain, they lived on the fruit of the oak. Acorn bread was certainly better than the bread the Germans made from grass, seeds, and roots. Man was unwittingly turning back thousands of years to primitive times when he gathered any plant that he could find for food. The most unnatural breads ever baked came from Sweden in these times; they were ninety-percent bark and straw. But man instinctively looked for better things to make his bread nutritious; the primitive custom of baking dried meat blood with floor was revived wherever animals were available. But animals of course were scarce because the first instinct in times of famine is to kill animals to keep the family alive for a few months. The final tragic result in the series of famines that spread over the eighth to fourteenth centuries was that men became like wolves, eating anything and everything they could catch.

THE SPICE TRADE

Ancient and medieval man, like his modern brother, wanted something more from his food than the relief of hunger. He also wanted tastes pleasing to his palate. His fare was limited, his food was monotonous. To make his frequent winter diet of salted meat, often oversalted, more palatable, he flavored it excessively with any available spice. The recipes of his day were all strongly flavored. Every household that could afford it used huge quantities of spices which, due to the cost, contributed greatly to the financial burden.

Spice was more frequently used in the days before refrigeration than it is today; it generally was used to disguise taints in food. Certainly, zest for spice still is more apparent in warm and tropical climates where putrefaction of food takes place more quickly than in the north or where there is more need to stimulate the appetite. Food acceptance has been influenced greatly by the use of spice, and man's food supply has thereby not only been conserved but perhaps increased.

Most of the world's spice originated in the area about the Indian Ocean. India was the most important source of spice but Indonesia and Ceylon also contributed greatly.

The outstanding spices of the past were cinnamon, cloves, nutmeg, pepper, and ginger, all of which have been known to man and highly valued since earliest times. Cinnamon was the most ancient of all the spices. Cloves and nutmeg were at one time worth their weight in gold; cloves were used by the Chinese centuries before Christ. Pepper was one of the first spices to be used by the Europeans. Medieval man used all these noted spices but also liked mint, caraway, and cardamon. The richest men in medieval times were the spice merchants. A pound of ginger was the same price as a sheep; a pound of cloves would buy a cow; a sack of pepper was worth a man's life.

Pepper has spiced not only men's food but also his fortunes throughout history. The ancient Egyptians left pepper corns in tombs for the enjoyment of the deceased in afterlife; kings frequently chose pepper as a gift to other kings. In 410 A.D., Alaric, the Visigoth, demanded three thousand pounds of pepper as his price for lifting the siege of Rome; his warriors were very fond of pepper.

For thousands of years the civilized powers of Europe traded with the Indies, but they traded so indirectly through Arab middlemen that the source of the spices remained a secret. Until the thirteenth century the Arabs could name their price and get it. It was not until Marco Polo's day that the European came to know that most spices came from the Indies.

Pepper hunger in the fifteenth century not only enriched the canny spice merchants holding stores of the commodity, but it also helped spark exploration for spices that eventually opened up new worlds to colonization. The desire to reduce the price of spices was another cause of the growing interest in Asia toward the end of the Middle Ages. As prices mounted, European navigators sought alternate open sea routes to tap the spice wealth at its source. But it was Marco Polo's story of seeing spices gathered and shipped in the Indies that aroused the necessary interest. At the end of the fifteenth century, the seaborn spice trade of the East was still in the hands of Mohammedan middlemen.

In 1497 the Portuguese navigator, Vasco da Gama, sailed from Lisbon around the Cape of Good Hope on his way to India. When he stopped at Mozambique, he met an Arab who offered to pilot him to Malabar. There he was welcomed by the local Hindu ruler who gladly sold him supplies and precious spices. Arab traders sullenly looked on while da Gama loaded his ship. It took da Gama over a year to get back to Portugal with a load of pepper, nutmeg, cinnamon, and cloves, but he became famous and rich. With da Gama's voyage the control of the spice trade by the Mohammedans ended.

WORLD EXPLORATION

The Search for New Frontiers

In his search for foodstuffs and riches, early man was forced to make long journeys to explore his distant surroundings. Ancient man had ventured on lengthy voyages across the open sea. Around 1500 B.C., many

Immigrants seeking a new life. (Courtesy of Bettmann Archive)

Hindu articles of trade were in circulation as much as twelve hundred and fifty miles from India. Sailing ships had been driven by the monsoon winds across the Indian Ocean. Without sails there would have been no early world exploration.

The Portuguese

In the race for an ocean route to the Indies, Portugal had several advantages over the other competitors. She was a maritime nation, well situated for such explorations, and the first of the peninsular states to expel the Arabs from her territory. Consequently, Portugal was the first to consider the possibility of independent access to the Eastern trade, outstripping all other navigators, even the Genoese and the Venetians.

Portugal's greatest asset was her Prince Henry, the Navigator, 1394–1469. Without Henry the best route to the Indies might well have been discovered by someone other than Vasco da Gama. Henry kept the first printed logbook in which he recorded the difficulties of long sea voyages and of obtaining crews to undertake them. During his lifetime about fifteen hundred miles of the African coastline were explored. It is from his records that we learn the extreme importance of food in determining the success or failure of world explorations. Food was both a necessity and an obstacle.

The ships of that day were too small to carry much food. The three ships of Columbus carried cheese, spice, peas, lentils, beans, rice, raisins, almonds, garlic, salt meat, salt fish, flour, biscuits, olive oil, honey, wine, and vinegar. The food was monotonous and subject to spoilage. The voyage lasted only one month and Columbus did not lose any of his men, but most of the exploration voyages were of longer duration. Because there was no refrigeration, the food spoiled. Lack of water was a great problem and, above all, there was the scourge of the sea, the dread disease scurvy, which resulted from lack of fresh fruit and vegetables (see Chapter 1).

The Vikings

The Vikings—in search of fish, timber, and new frontiers—sailed from Norway and Denmark first to Iceland and then to Greenland. The Greenland Vikings lived on meat and dairy produce. Cattle breeding could be carried on only in the sheltered fjords where the necessary pasturage could be cultivated in the high summer temperature. The summer season was short, and there were only a few weeks of fine weather to get in the harvest. Their animals consumed huge quantities of fodder. Cereals and vegetables were in short supply, but as long as the Vikings were able to trade with Denmark and Norway, they could import cereals, vegetables, and salt. However, the Vikings paid for them handsomely. When depreciation of Norwegian merchant shipping increased and there was no incentive to replace obsolete ships, sailings from Norway to Greenland became less frequent.

The Greenlanders visited Maine, New Brunswick, and Nova Scotia. There was no shortage of fish there, and the land was fertile. They are said to have located vines and grapes and cornfields. When spring came, they sailed home. Their tales of the foods of Wineland (Vinland as they called the east coast) sounded like fairy tales to the Arctic Greenlanders. Ships plied regularly between Greenland and Vinland up to the mid-fourteenth century. It is claimed by some writers that the Greenlanders brought the first cattle to North America. Later such long voyages by these sea-rovers became less frequent and finally ceased, perhaps because the Norsemen, undernourished due to the breakdown of their daily farming over several centuries, lacked the strength to continue. When their supply lines of food and nutrition from Norway were cut, the Norsemen succumbed.

When the settlers of the Greenland colony had been dead for four centuries, Denmark sent a scientific expedition to learn about their Northmen forefathers. They found ruined farms, wild oats, and weeds and in graves in the frozen soil—well-preserved corpses. These dead were severely crippled with rickets and dwarflike in stature. Hardly any of these malnourished creatures had lived to be more than twenty. Explorations and settlements must be supported by food to be successful.

Foods Brought Back from Explorations

Maize

Columbus, in 1492, did not intend to do more than bring back the gold and silver of the Indies for the King of Spain. He did not know that among the things he brought home, one would be more important than gold—maize. Just when Europe's peasants of the Middle Ages were forgetting what the plow and oxen looked like, seeds of grain that required no heavy tools for cultivation were made available to them.

In Europe, the continent of wheat, rye, oats, and barley, no one suspected that the new seed would be revolutionary in its effect. Columbus brought maize home only as a curiosity. But a grain that grew in only three months and that needed neither plow nor oxen could not fail to convert to itself the Spaniard and the people of the Mediterranean. By the seventeenth century, maize had become permanently established as the food of the common people in Southwestern Europe—except in France. The most ardent efforts of Benjamin Franklin, America's Ambassador to France in the late eighteenth century, failed to convince the French people of the value of maize as a food for humans.

The Potato

The Spaniards found the potato in Peru in 1531. It is not certain by what means the potato came to Europe, but the future diet of Ireland, France, and Prussia was related to its coming. How the Spanish peasant must have welcomed a plant that needed neither plow nor draft animals for cultivation. From Spain the potato was accepted cautiously by Italy and Austria; by the late seventeenth century, all Ireland was living on potatoes.

IN IRELAND—By the time the nineteenth century arrived, seven generations of Irish had cultivated and eaten potatoes. In many areas the potato was the only food of the Irish laborer and water was his only drink. The famine of 1822 was due to a poor potato crop. Potato blight suddenly appeared on the Island and the disease persisted. By 1846, it reached alarming proportions. Stark famine was upon the land, and in the wake of the famine came influenza. Within the next five years nearly a million people died—a fifth of the population. For the first time in Ireland there came the urge to flee the country. In the first ten months of 1847, a quarter of a million stranded Irish landed in Liverpool on their way to America. Only half of them, sick and sorely stricken, sailed on. Whole families starved during the crossing.

Those who arrived in America did not go west like the Germans. These Irish immigrants mistrusted all soil; they settled in the east and became city folk. Like the potato, the Irish took vigorous root, but in the soil of the great cities. By 1910, of the twenty-five million inhabitants of the United States, four million were Irish. Thus a distant potato famine thoroughly changed the population and the political face of many American cities and exercised a decisive influence upon contemporary America.

IN GERMANY—King Frederick the Great, early in the eighteenth century, forced his Prussian army and the people to cultivate the potato. The people rebelled because they said that in years gone by it had brought leprosy into Prussia. Frederick the Great had to put soldiers on guard to protect their plants because the peasants dug up the bulbs and threw them to the pigs. It was not until the king publicly ate potatoes that the skepticism of the peasants began to fade. Example had its telling effect, and victory in the Seven Years War changed their minds completely. When the Austrians and the Russians set up a blockade against the import of grain, the Prussians had the potato to supply their food needs.

IN FRANCE—Antoine Augustin Parmentier, a modern nutritionist, had learned about potatoes as a prisoner of the Prussians in the Seven Years War; for months he had lived on them. He recommended the potato to France as a partial solution of the food problem in the late eighteenth century. He recommended it not only because it satisfied the appetite but chiefly because it required a minimum of farm equipment and grew to maturity quickly. Besides it was not poisonous as so many believed—no one in Prussia had died from eating potatoes.

Parmentier's arguments gained some attention. He was given five acres of land by the king for experimental planting, and a school for bakers was operated in 1780. But much of his support was only token support; the abhorrents of the potato were united, active, and vocal, especially against potato flour. They emphasized that it was an insult to force potato flour on the lower classes for whom it was intended. Potato flour for baking was the weak spot in Parmentier's propaganda and the reaction against it was great. Parmentier failed in his efforts to save France from hunger. In 1787 the Revolution broke—it was useless now to consider the potato.

COLONIZATION

For millenniums the Far East was known as the area of great wealth and power. Today a remarkable contrast exists between the wealth of the West and the poverty of nearly all the rest of the world. Why have some countries been able to progress to increased wealth while others have been left behind?

Barbara Ward, in her book *The Rich Nations and the Poor Nations* (1962), points out that one outstanding feature of Western society has been its urge to modernize. This inspiration has been largely lacking in primitive society. The modernizing tendency was initiated by Western colonization. Western merchants risked time and money to bring back spices and foods from the East. They tried to set up monopolies for themselves and to supplant the traders of other countries. In doing so they became conquerors but their energy, production, and savings made capital available for the development of our existing economic system.

One of the side developments of trade was that all the trading nations of the world found it necessary to maintain stations for their ships so that they could take on necessary supplies. The establishment of these stations opened up a new situation in colonial politics. These places were often not supply centers but rather strategic food depots. Food had become the most important of the supplies, and colonies naturally grew up around these centers.

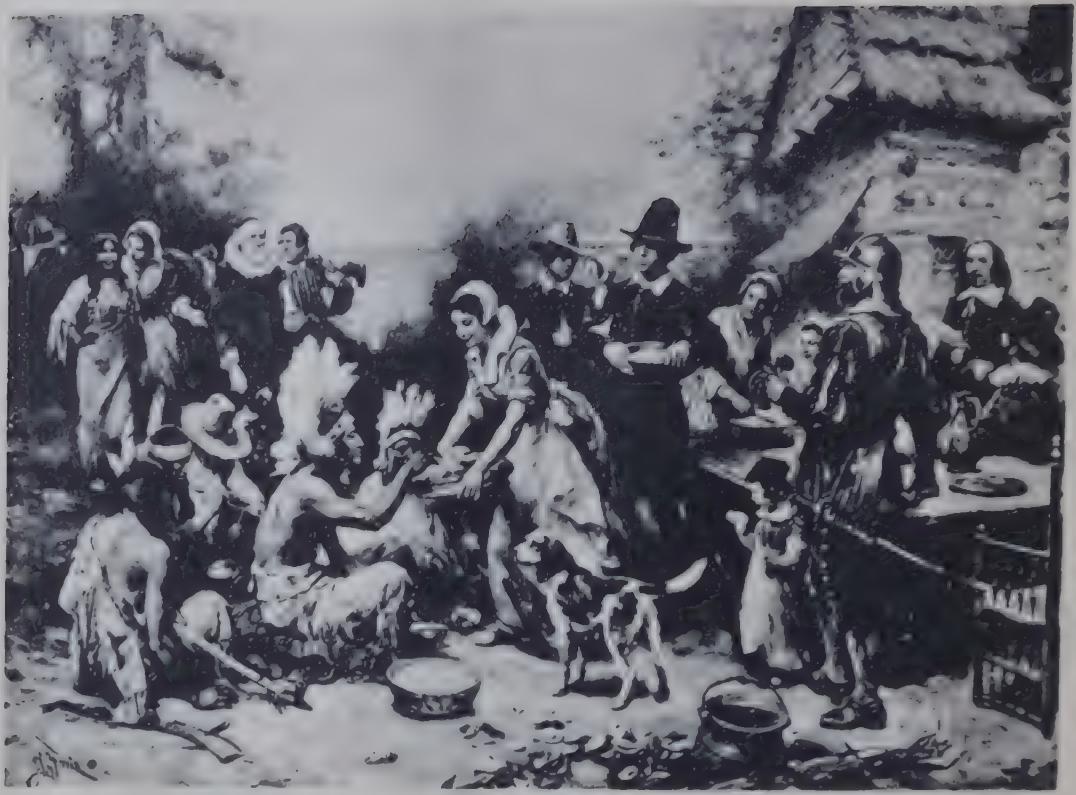
In the mid-seventeenth century, India, already colonized and controlled by the British, had many articles of trade which other countries needed and wanted. The long trip from Europe to India around the continent of Africa was fraught with the dangers of scurvy to which the sailors fell prey after their supply of fresh vegetables and fruit was exhausted.

One interesting story was what the wise merchants of the Dutch East Indian Company decided to do about this. Jan von Riebeck was sent as a leader of a party to Capetown South Africa, until now an ignored and really unknown land. These colonists were to raise gardens and livestock expressly to supply the sailing vessels on their way to India. They even were forbidden to leave the Capetown area, but some who became the South African "foretrekkers" did break away. Thus an area now known for its fertile and highly productive farms got its start by furnishing needed food to sailors. Other nations established colonies on islands off the Coast of Africa for the same purpose.

THE SEVENTEENTH TO NINETEENTH CENTURIES

America

Maize was readily accepted by the American colonists as their food even though they had been users of wheat or rye. They could not help but



The Indian gift of corn in America. "The First Thanksgiving" painted by Jean L. G. Ferris. (Courtesy of Bettmann Archive)

like a grain that required so little work. The rapid growth of the American settlements seemed consistant with the rapid growth of maize which was particularly well adapted to the frontier.

In 1763 the King of England issued a ban prohibiting settlement west of the Alleghenies. This was an underlying cause of the American Revolution, although the immediate cause was the tax imposed by the King on tea shipped by the British East Indies Company to Boston. The colonist could stand hard work and privation. But the existence of cheap vacant land to the west with its resources had an overwhelming attraction for him—he could not accept a static frontier. The farmer colonist fought the British and, after nearly eight long years, finally won the war. Thereafter the frontier colonizers pushed westward and the American continent was settled rapidly.

The building of a seven-story flour mill in Philadelphia as early as 1740 was a typical project that symbolized the power and progress of America to come. It was larger than any such mill in Europe.

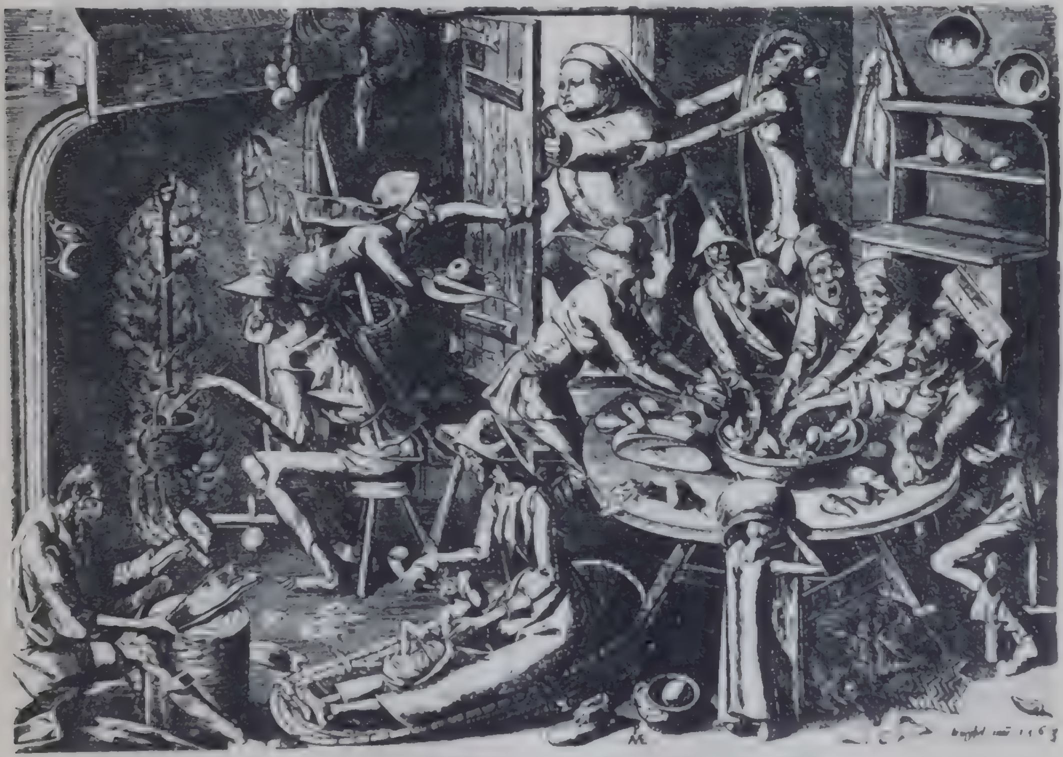
But everything is not always happy and progressive in any land. Negroes who were forcefully captured in Africa were held in slavery in the South as late as the middle of the nineteenth century. The North protested against this economic form of labor; the South hoped to solve the problem by leaving the Union. The North would not agree and the War for Southern Independence began in 1861.

Europe

The eighteenth century saw the extreme low in human development in over seven hundred years. Every country in Europe indulged in somewhat the same inhuman tyranny over the poor. Soup from herbs, substitutes for bread, beans, chestnuts, olives, native fruit, roots, and even worse made up a good part of the food of most people in Europe.

England

Early in the seventeenth century the art of the cultivation of market gardens was introduced into England from Flanders. The use of clover in rotation and of Dutch methods in farming and the production of beef and mutton followed. The seventeenth century was the century when the appearance of England was gradually changing from the open landscape of the Middle Ages to enclosed fields due to the substitution



During the Middle Ages, many were hungry. Painting by Peter Breughel. (Courtesy of Bettmann Archive) of modern for medieval methods. The great change was from land used in common to fields held and used in severalty, from community planning to individual control and private initiative. It was in this period that the English became interested in the raising of cattle, particularly the short-horned breed.

Late in the eighteenth century, life became miserable for the English small farmer. England had started to compete in the world's textile markets. Wool was the all-important component of English textiles, so England's fertile fields were turned into pasturage for sheep. Crops steadily decreased and prices of food rose beyond all reason. Entire regions became barren; the farmers who inhabited them were forced into the cities and became slaves of the mill.

As late as the middle of the nineteenth century, closely one-third of the population of England—the neglected one-third—lived on potatoes with an occasional meal of corn. The middle third of the people had to be content with bread of wheat or oats and occasionally a meal of fat pork. The top third were apparently well fed. In Scotland, agriculture was still elemental; hardly an edible root vegetable nor even a garden green was raised—nothing but oats.

France

STARVATION—Civilization reached its low in France at the end of the eighteenth century. By 1700 different provincial governors officially reported that France was slowly dying of starvation. By 1715 six million people—one-third of the population—were already dead. In 1780 Parmentier, the nutritionist, recommended the potato at least as a supplementary diet. In the same year Benjamin Franklin, United States' Ambassador to France, made a forceful effort to have France import maize from America. Neither effort was successful. Within a decade it was too late.

For centuries the Parisians were commited to the eating of wheat bread. They would not touch macaroni or potatoes, and they did not like the smell of maize flour. Oats were "food only for horses." In retrospect it is astonishing that the art of market gardening, which can be traced in its migration from Moorish Spain to Lombardy and in about the twelfth century to Flanders, also was apparently of no interest to France. Market gardens could not avert a famine but they could save many lives.

THE REVOLUTION—To add to her woes, France was afflicted in August 1789 with a drought more severe than any in memory. Streams were dry and the water wheels were still. The supply of bread dwindled and its price rose precipitously. The masses believed that the King and Queen and their courtiers all had bread. "On to Versailles" was their rallying cry. On the morning of October 5, 1789, at least fifty thousand men, women, and children marched with their pikes and weapons only to find that there was no bread at Versailles. They took the King and Queen—but no bread—back to Paris.

The revolutionaries thereafter governed France and their leaders realized that getting bread was their first responsibility. Nevertheless, they had to tell the people that war was imminent and that there would be still less. By 1792 war with all of Europe was a fact. Beset with all her problems, all Frenchmen closed ranks, sacrificed, and put their best efforts into winning the war. The magnificent exertions of a united nation succeeded when the Austrians were driven from French soil.

The five years of peace between 1800 and 1805 permitted the French soldiers to return to their farms which then were producing wine, vegetables, tobacco, and cattle; grain from Russia and the Ukraine once again was moving into France.

INDUSTRY OVER AGRICULTURE—Although Napoleon I, who came to power in 1804, was interested in industry rather than agriculture, he insisted that all products of the soil must be permitted to make their contribution to industry. A growing interest in cultivation attracted him to Parmentier whom he considered inventive and whom he placed in a high civil position with orders to plant potatoes all over France. Use in the chemical industry for surplus potatoes presumably could be found by the inventive mind.

At the same time, all was not going well in the grain fields; shortages were slowly developing. An Emperor more interested in basic agriculture would have noticed this but not Napoleon. And when Alexander of Russia lined up with Napoleon's enemies, the supply of cheap grain from Russia and the Ukraine faded. When Napoleon's vast armies marched through Poland to Russia, hunger was an unwelcome visitor to France.

Science and Technology

Technical Slumber

The period which extended from the late Middle Ages to the nineteenth century was a period of little technical progress. Resistance to change was characteristic of the Dark Ages. Farming tools and mills were destroyed by the northern barbarians. The classic civilization was laid waste. As the supply of food dwindled, man was forced to attempt to repair his mills. Slowly he awakened from his technical slumber.

The Industrial Revolution, begun in 1750, caused many changes in man's way of life and in his social and economic development. It was accompanied by a mechanical revolution, the result of the development of science.

Mechanization and Chemistry

In America the important outgrowth of the technical awakening was the conviction that food scarcity was no longer inevitable. Increased mechanization was the important practical application of this conviction. Invention followed invention. The introduction of the Bessemer process in the production of steel and the increasing awareness of the country's great natural resources gave impetus to and confidence in the industrial economy which grew at a rapid rate. After 1850 farms were mechanized rapidly. The iron plow replaced the wooden plow and was replaced in turn by the steel plow. Oxen were replaced by horses. Tractors for plowing, seed drills, and mechanical reapers followed. An end result was the production of the combine which united in one machine harvesting and threshing operations. Mechanization allowed the farmer to produce for the masses rather than solely for his family. More laborers were needed. By 1800, land-hungry immigrants were pouring into America which promised freedom and land for the asking.

Europe took a different course. In America the machine was used to work the fields. In Europe chemistry and biology were used to enrich them. A German chemist, Justus Liebig, proved in 1848 that four chief ingredients were essential to the soil: nitrogen, potassium, lime, and phosphoric acid. If grain was to grow, these substances had to be present in the soil and present in certain proportions. Better tools, mechanization, and fertilization all combined to bring about great improvements in American agricultural methods.

Domestic Market

The growth in agriculture and population increased in parallel fashion; urban areas grew and so did the nonagricultural population. The promise of fertile lands in America was attractive to many people, particularly from Europe. The result was a massive growth in population. It brought cheap labor into the nation and increased the market. A broad market for food was created. The American farmer now could concentrate on producing what his land was best suited to produce. Specialized farming ensued.

By 1825 food was being transported from western markets to eastern markets by the Erie Canal. To transport the stream of wheat from the fields across the nation to the seaports for quick shipment to overseas markets, a network of railroads was needed. "Build Railroads" became a slogan; they became economic necessities. The first transcontinental railroad, the Union Pacific, was completed in 1869, opening up the west. Once the west was opened, the grange cattle industry developed. The canning of meat and the invention of refrigeration both added to the transportation cargo. The first refrigerated boxcar was invented in 1868. Both wheat and beef travelled east to the major markets. The meat-packing industry soon followed.

Export Market

Technology, both mechanical and chemical, won out in the battle with the soil. So America was encouraged to expand her wheat lands—wheat, not maize—because Europe wanted wheat. The French Revolution convinced all nations that a "master race" ate only wheat. Paris became the authority of taste; contempt was heaped upon every grain but wheat. Most of Europe was converted to wheat except where rye was firmly established as in a large part of Germany and Russia.

To meet the increasing demand for wheat export, wheat had to make a compromise at home with maize. Maize was America's stock food and an economic factor of far-reaching importance. Out of the maize plant grew the centers of the meat trade with its by-products without number.

Genetics

In a paper published in 1865, an Austrian monk, Gregor Mendel, presented three basic laws of heredity: (1) the law of segregation, (2) the law of dominance, and (3) the law of independent assortment. This paper was found and read independently in 1900 by three European botanists and an American agronomist. In his book, *Principals of Agronomy*, Lorentz Pearson points out that Mendel's laws form the foundation of genetics upon which everthing discovered since 1900 has been based.

Corn in the United States today is concentrated around hybrid production which makes possible a 25–50 percent increase in per acre yields. Until the turn of the century, scarcely any wheat could be grown in Canada or Siberia. Several varieties of both high-yielding and rust-resistant wheat have been developed by crossings; they grow most successfully in Canada. As a result the Canadian economic outlook was completely changed and improved within a few years.

Agricultural Catalysts

The American public took an active part in catalyzing agricultural development. Land first was acquired and allotted to farmers for settlement. Land grants were made to railroads so that products could be transported quickly to markets. To encourage research and education, agricultural colleges and the United States Department of Agriculture were created in 1860. Public land grants were given to each state; the monies from the sale of these lands were to be invested; the income was to be used to create and maintain the land grant colleges devoted to agriculture. The Hatch Bill in 1887 ratified a system of experimental stations that were to specialize in research work on crops and livestock. Investments in irrigation, reclamation, and credit facilities also gave impetus to the development of agriculture.

The major purpose of the above grants and investments was to lessen the amount of the national income that would be required yearly to produce food. America produces a surplus of food today with less than ten percent of her labor force. Underdeveloped countries use seventy-five percent of their labor force in food production. When the farms first were mechanized in 1850, one farmer produced enough food for 4.68 persons. In 1910 when animal and mechanical power were at their peak, one worker supplied eight persons. By 1952, eighteen persons were supported by one farm worker. Labor and other resources are thus freed from food production so that they may be utilized elsewhere in the building of the nation.

EFFECTS OF WAR

Machiavelli wrote: "It always was (and 'tis reasonable it be) the design and end of all those who make war to enrich themselves and impoverish the enemy, nor is conquest and victory secured upon any other score."

As the population of the early tribes increased, the pressure for survival drove the members into battles for food. The tribe would migrate from the tribal tracts in search of land and plunder. This incentive carried the Mongols into India, China, Mesopotamia, and as far west as Europe. The Medes and the Persians descended from the Iranian plateau to take over the fertile fields of Babylonia and Sumeria. The Gothic tribes more than once invaded the Roman Empire.

Wealthier agricultural communities, such as Carthage, often fell prey to a resolute adversary. The Carthagenians were such efficient agriculturists that their success engendered jealousy, perhaps fear, on the part of the Roman land owners. Rome wished to dictate the trade policy of Carthage which would mean the export of grain from Africa to Italy where it was needed. Instead, Carthage was exporting oil and wine, a trade which Rome hoped to monopolize. Cato, a powerful Roman figure and the head of the land-owning party, visualized the prosperity of the Carthagenians as a threat to the Roman economy. "Carthage must be destroyed," admonished Cato until his policy was approved. In the Third Punic War, 149 to 146 B.C., the Romans ruthlessly destroyed Carthage, put to death most of the population, and symbolically drove a plow through the ruined city. "Those who live by the plow, must perish by the plow," said the Romans.

Great military commanders of both the ancient and the modern world knew that strategical movements of armies depended to a large extent on their ability to obtain food. If armies were cut off from their food supply, they courted disaster. Darius I, king of the Persians, routed his immense army across the Bosporus through Bulgaria and across the Danube, northward to starvation, suffering, and defeat; there was no pitched battle but the Scythian horsemen cut off the food supplies of the Persian foot soldiers. Both Xerxes, son of Darius, and Frederick the Great knew the value of commisariats. Xerxes placed vast stores of food along the path of his armies. Frederick the Great was careful to have supplies within easy reach of his troops even though this slowed the advance of his army considerably. An old practice of ancient world generals was to move the army parallel with the sea so that the fleet might supply the needed food. The Roman legions carried their own food—wheat, rye or barley, pork, lentils, vegetables, and wine.

As early as 1807, five years before his defeat, Napoleon stated: "If I have bread it will be child's play to defeat Russia." The granaries of France, however, were empty when Napoleon marched into Russia. France was not a good grain producer and had to depend on imported grain from Italy and Germany. Much of her wheat, rye, and oats was taken by the army to Russia. But Napoleon did not wait for the food trains, depending on the Russian stores to feed his army after he defeated Russia. The Russians, on their retreat before the French in the fall of 1812, destroyed everything—the land was barren. After Moscow was burned by the Russians, Napoleon ordered a retreat back through Poland. Then began the utter ruin of Napoleon's army and the greatest grain disaster of all warfare. At first the men ate oats and horsemeat and drank the hot blood of the horses. But the foot march through snow and ice in freezing temperatures took three months. The men starved and froze. When the remnants of the French armies reached Poland, the odor of fresh bread drove the soldiers frantic, even insane; they would kill for even a morsel of bread. "Bread is an army's greatest ally, the soldier marches no farther than his stomach," says a Russian proverb.

At the beginning of the Civil War in the United States, the South was rich and had many friends in Europe and even in the North. Two-thirds of the United States' exports consisted of cotton from the South;

cotton kept the factories of England and France busy. The South relied heavily on the economic power of cotton to force England to keep a free flow of cotton to English factories. But England failed to do so and the blockade of Southern ports by the North continued. Some historians have indicated that England failed to intervene because of her lucrative grain trade with the North. Since grain production in the North increased in spite of the war, both the Northern armies and the civilians were well fed and much of the surplus production went to England.

By the end of 1862 the Southern states were concerned about losing the war. Southern farmers had turned from the production of cotton to the production of grain. Realistic men proposed that bacon be purchased from the North for cotton. By 1863 the grain bins of the South were empty and famine affected even the white land owners and aristocratic planters. The blockade was successful and the defeat of the South was inevitable. England and France needed wheat more than cotton, and wheat meant victory.

Between 1909 and 1914 the Russians sold half their barley crop and much of their oats to Germany. With the outbreak of war in 1914, the Russians well understood the purpose of the German purchases. German wars traditionally had been short wars because Germany was dependent upon imports of food and supplies. The war of 1914 was planned to last one year but the outcome was not so speedily decided. At times it appeared as if Germany was waging a successful war but internally Germany was hungry. She was handicapped by having to fight on two fronts and was being hurt seriously by the British blockade. When America entered the conflict, her men were the best fed on the battlefield. Two-thirds of the total military food needs were supplied by canned goods. The might of American wheat and of American manpower decided the outcome of World War I.

Nations are not prone to undertake warfare without the means of conducting it successfully. Military strategy and military might, economic factors, availability of food supplies, and other factors all mitigate for or against final victory. But at certain stages of conflict, one factor is likely to supersede all others in importance. It is difficult to win any war if military might is lacking. It is very difficult to win a long war if an army is starving.

STUDY QUESTIONS

1. Why was prehistoric man basically a food gatherer and what conditions had to exist before he became a food producer?

2. What part did bread play in making the Roman Empire great and what part did bread play in its downfall?
3. Scarcity of food was something no longer periodic but permanent during the Middle Ages. What were some of the factors which created such conditions? What was the basic food of the Middle Ages?
4. The search for the spices and riches of the East fostered many explorations which ultimately brought great wealth to many people. But can you explain how the simple foods brought back from these explorations also had a profound effect on the history of nations?
5. How was food an obstacle to exploration? How did the need for fresh food supplies on long voyages affect Western colonization?
6. In the seventeenth, eighteenth, and nineteenth centuries, the idea that scarcity of food was not inevitable permeated the thinking of Americans. How did the Americans react to this idea? Can you contrast the food situation in America with that in England and France during these times?
7. Can you explain how bread spells victory in war?

TOPICS FOR INDIVIDUAL INVESTIGATION

1. Choose any one food and trace its origin, pathway through history, and social impact on the world.

2. Trace the history of the Fertile Crescent in Asia and the peoples that it has fed throughout history.

3. It has been said that in any conflict of ideologies food will be the deciding factor. Support or refute this idea and develop your thesis.

4. Discuss why the East, the source of the early riches and the envy of the world, has been left behind in the world's present thrust towards greater wealth.

5. List the grains used by ancient peoples and the factors that determined their use.

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3

FOUNDATIONS OF FOOD IN AMERICA

COLONIZATION OF AMERICA

In colonizing America the characteristics which people possessed showed in their choice of new homes. The Puritans from England migrated to the cold forbidding shores of New England. It was not surprising that people from sunny Spain and France chose warmer southern lands on which to settle.

Maryland and Virginia became the area for those who wanted extensive farming lands which could make the homesteader a lord of the manor.

The South

The Spanish

The Spanish became the first colonizers in America when Columbus brought fifteen hundred settlers to the island of Hispaniola in the West Indies on his second voyage in 1493. This island became a base for further Spanish expansion into Florida, Mexico, and Peru. The Spanish also explored areas of Texas, New Mexico, and Arizona. St. Augustine, Florida, was founded as a permanent settlement in 1565; the Spanish were prominent in Florida until 1819 when it was acquired by the United States. These colonizers made a great contribution to the world's food when they found chocolate which the Aztecs had and introduced it into Europe and America.

The English

The English sought riches in America as well as in India; settlements resulted in Virginia in the South and in Massachusetts in the North. The Atlantic seaboard was the first English frontier in the United States. Until 1763 this frontier was contained by the French and their Indian allies to a strip of land about one hundred miles wide along the coast.

In 1607, nine ships with eight hundred passengers and crew set sail from England for Virginia. These adventurers hoped to profit from the natural resources and land of the new country. They brought with them cheese, cured fish and meat, oatmeal, bread and biscuits, beans and onions, dried fruits, seasonings, and butter (which probably spoiled en route). The ships also carried barrels of beer, cider, and water. For future planting they brought bags of seeds of a variety of vegetables. Six hundred and fifty immigrants reached Jamestown.

The Indians brought the colonists gifts of corn. They showed them how to make ash cakes and taught them where fish could be caught and what wild game and fowl were edible. But the inexperienced colonists were unable to adapt themselves to the climate, and many were unwilling or unable to do the hard manual work that was needed. Many attempted to live the life of the English gentlemen. In the winter of 1609–1610, the population was reduced from five hundred persons to sixty.

Immigration continued and by 1617 the population had increased to about four thousand. But the immigrants had not yet learned how to farm, nor had they learned from the Indian how to survive. The result was that by 1624 famine and the sickness that enused had reduced the population to 1275 people.

Attracted by the possibilities of the tobacco trade, new colonists came. Virginia tobacco sold well in the English market and lent assurance of stability to the settlement. Nearly all the colony became engaged in agriculture, chiefly tobacco farming. But the methods used in growing tobacco soon exhausted the soil. The colonists found it more profitable to clear new land than to restore the old. Because new land meant higher yields, tobacco farming made for the extension of the farming area westward.

In the spring of the year the first and most important work of the colonist was to plant a garden and a field of corn. Squash and pumpkins were easy to grow and were usually present in the garden plot. Turnips and other vegetables, whose seeds had been brought out from England, also were grown. Corn was the staple grain of the frontier and the colony. It was prepared as corn bread. Cracked corn was made into hominy. The Indians taught the settlers how to grind their corn by using mortar and pestle—the mortar was a hole formed in a stump and the pestle was a log.

The first hogs in the colony were brought in 1652. They were well adapted to the frontier and the colonial farm because they could survive on kitchen waste and the forest acorn. Later they were allowed to roam widely and to eat the peanuts grown by the planters. As a result their meat had a delicious flavor. It was dipped in brine and then hung from the ceilings of smoke houses. Salted pork very early became the staple and preferred meat of the colony. Beef was a welcome addition to the diet when available. And the nearer the frontier, the more important game became. Beef and game were dried according to the methods of the Indians who had been doing it for generations.

In the coastal areas, rice was the major crop. The original seed grain was said to have been a single bag bought by a Charleston merchant from the captain of a ship which made an unexpected stop at Charleston, South Carolina. Rice, like tobacco, found ready markets in Europe and trade flourished.

The increase in trade was followed by an increase in production and a necessary increase in the labor force. A great influx of Negro people altered the social and economic structure of the South. The Negroes were bought in Africa and sold as slaves in the early colonies. They labored in the hot southern sun to raise tobacco and cotton crops. Plantations grew larger with plentiful labor, and the land grew rich. Other crops besides the staples helped to build a sound economy. Wild fowl, venison, beef, veal, and mutton were abundant. The cooking of the South became lavish. Planters enjoyed an early morning mint julip, followed by a breakfast of hot breads, meat, chocolate, and tea or coffee. Soup, game, chicken, or fish with greens made up the mid-day meal. The Sunday meals were particularly bountiful. Soups, breads, turkey, chicken, ham, mutton, sweet potatoes, vegetables, jellies, sweets, beverages, wines, and liquors were available and abundant.

The economy of the South was a prosperous one. The people were practical but generous. The colonization begun in 1607 was being justified.

The North

When the Pilgrims from England landed at Plymouth in 1620 they found a rocky, nonfertile soil. It has been said that a shortage of beer and its adverse effect on the sailors had much to do with the diverting of the Mayflower from its original destination further south. Since the meat, fish, butter, and cheese that they brought with them had spoiled, the new settlers of Massachusetts Bay had little food and poor shelter for the winter. The Pilgrims literally starved; there was an abundance of fish in the streams but the Englishmen were pitifully inept at contending with Nature.

The Pilgrims needed food desperately and the Indians befriended them. The Indians gave them corn, the grain that needed so little attention. They showed the pilgrims how to plant beans between the rows of corn so that the stalks could provide support for the bean tendrils, how to store the ears of corn in ventilated cribs, and how to grind the corn by the Indian method. Corn, sweet potatoes, pumpkins, and squash had all been cultivated by the North American Indian for generations. Root crops such as cabbage, carrots, onions, parsnips, and turnips were introduced by the settlers and grew well in New England as did the beans. The beans were much favored by the Indians and were baked by them in earthern pots. Beans are to this day a favorite food in New England.

Fish was available along the Atlantic and in the rivers. Smelt, halibut, pearch, mackeral, trout, and herring were favorite fish foods and were generally salted down for consumption in New England and adjacent New York. Boiled cod was a favorite New England dietary staple. Lobster was sometimes enjoyed but shad was considered unfit to eat.

Meals in early New England were mostly of the one-pot type, cooked in vessels hung over the hearth. The housewife had neither slaves nor help and did her own housework. She had to put together meals from whatever food could be obtained on the farm or found in forest or stream. She must have been frequently overworked and it was reasonable that she persisted in the slower cooking methods of boiled meats and fish stews. Spices were used rather liberally, especially with poultry. There was no refrigeration and, as with early man, spices served the two-fold function of preserving food and disguising taste.

Apples were the most popular fruit because of their value in the making of cider—a favored drink. Peaches, pears, and plums were grown also but they were suitable only for preserving and the high cost of sugar prohibited this.

The favorite meat was the corn-fed pig. The colonists fed their plentiful corn to both pigs and cattle. Frontiersmen knew well that the pig yielded a quick return. Good keeping qualities and satisfaction of the appetite also made for the popularity of the pig. Later in frontier days, some sheep were imported from Spain but mutton remained a delicacy. Cattle raising eventually became a leading industry in New England. In the early eighteenth century, when the farmers of the frontier pushed westward the cattlemen and their herds were at their head.

In the early days of the colony, venison was always plentiful. But as the colony grew, game became less abundant. Later in colonial times, milk was available. Butter was scarce as late as the seventeenth century; there were few churns. Sugar was scarce but wild honey, maple sugar, molasses, apple butter, and cider abounded. The ginger bread, brown bread, "rye and Injun" corn bread, and cranberry recipes are all associated with New England cookery.

In New England two factors tended to hold the raising of crops to a subsistence level, namely the difficulty of securing farm labor at moderate wages and a lack of markets for the diversified products. The division of labor had not proceeded far enough to create a large non-agricultural population and Europe did not need the products of the North. The southern boundary of Pennsylvania divided two somewhat different agricultural areas. North of that boundary there was no single staple. South of that line tobacco, rice, and cotton dwarfed all other agricultural action. This distinction was fundamental and eventually led to social differences.

The urge for new land was present in the Massachusetts colony as in all America, and there were those who could not tolerate the restrictions of the Puritan colony. In any case, by 1636 immigrants from Massachusetts had founded colonies in Maine, Connecticut, and Rhode Island. In culture and food habits they remained New Englanders.

Thanksgiving Day became a customary annual event, well established by the end of the seventeenth century. The first Thanksgiving Day feast celebrated in New England was typical—a huge pot of venison stew cooked over an outdoor fire, wild turkeys stuffed with cornbread and roasted on spits, pumpkins "baked" in maple syrup, boiled oysters in the shells, and husks of sweet corn. In addition pumpkin, apple, and mince pies were available.

The Middle Colonies

The Dutch

The trading post of New Amsterdam on Manhattan Island was established by the Dutch in 1614, only eight years after the first expedition to Jamestown. The earliest Dutch settlers preferred fur trading with the Indians to agriculture. However the Dutch East Indian Company offered tracts of land along the Hudson River to any ship's officer who would transport fifty settlers to the new colony at his own expense.

In March 1623, thirteen families arrived in New Amsterdam. They were forced to depend upon the natural resources of the wilderness during the first year, but in April of the following year an expedition of three ships brought additional settlers with needed agricultural and dairy equipment. This expedition also carried one hundred head of livestock, horses, hogs, and sheep. The Dutch were well organized, and both the voyage and the subsequent settlement of the colonizers were well managed.

The Dutch settlers willingly and gladly accepted the corn dishes of the Indians. They also enjoyed the available delightful food of those early days which included venison, wild turkey and geese, melons, and oysters. Soon they planted wheat and rye as well as tobacco. They were good farmers and produced excellent flour. Although the Dutch farmer kept a few slaves, this practice was not as extensive as in the South. Windmills were erected to grind the grain and to pump the water. A good foundation was laid for future agricultural development. The settlements steadily grew in size and importance. Because the soil was fertile, the Dutch produced large crops and sold the surplus on the open market. There is no record of any famine or even of want in the Dutch settlements of New Netherlands.

Later the settlers planted peach and apple trees and cultivated them successfully to maturity. They early enjoyed a great variety of the vegetables common to the market gardens of Holland including lettuce, beets, cabbage, cucumbers, parsnips, and radishes. They also enjoyed the native pumpkin, squash, and beans. Many of our present flour mixtures such as pancakes, waffles, doughnuts, honey and ginger cakes, and tea and cinnamon cakes had their origin in a Dutch kitchen.

The thrifty Dutch became prosperous. Manhattan Island was a good investment.

The Germans

These "Deutsch" people came to America early in the eighteenth century. They settled first in New York but later moved west to vacant land in southeast Pennsylvania, erecting a buffer settlement against the Indians. They were born farmers who knew something about soils and who were committed to hard, productive work. They raised all their own food, buying only salt and spices. Soup, breadstuffs, and vegetables were the first foods of the early pioneers. Later they were able to add milk, wild game, fowl, wild berries, and preserves to their diet. Their tea was brewed from herbs, their coffee was made from burnt rye or wheat, and their butter was cottage cheese. But soup was the mainstay of the "Deutsch" family. The soup kettle would simmer all day over the open hearth, receiving bits of leftover meats and vegetables. Their soups were always excellent but frugal.

In the course of time the "Deutsch" farmer was able to grow and stock a normal variety of general provisions. But the household did more than that. The farmer produced cider which he used to make vinegar; the women made extra cakes, pies, bread, cheese, and sausage which were sold in the town markets. Vegetables were grown in the summer, but they were always vegetables that could be stored for winter use. The meat dishes were all appetizing and nicely flavored; chicken pot pie and sauerbraten were two favorites. Shoofly pie became famous; their "munching" pies and their various cookies were eagerly sought by townspeople.

The Deutsch people themselves liked pancakes and served them frequently with sausage meat, gravy, molasses, syrup, farm jelly, or applesauce. The established household could count on a daily fare chosen from the following: bread, milk, cornmeal, potato and noodle soup, pork with sauerkraut or dumplings, sausage, liverwurst, scrapple, pickled pigs feet, bread and apple fritters, preserves, jellies, applesauce, cottage cheese, salads, and a wide choice of pie and cake.

Practically all of the above diet was a product of the farm and household. Self-sufficiency was a matter of pride to the Pennsylvania "Deutsch" people.

The Quakers

New Jersey or part of it was originally intended as a retreat for Quakers intent upon a peaceful life in a new country. In 1664 some two hundred and thirty families arrived from England, Ireland, and Scotland, destined for farm lands then available on liberal terms. The Quakers were well-to-do, practical, industrious people. They liked the sober, modest life, lived close to the soil, and saved their money. The common problem shared by all colonists arriving in America was the necessity of finding food and shelter. These New Jersey colonists were no exception; they lived at first in wigwams and caves. Before the first crop could be harvested, they suffered great hardships.

The Quakers lived in friendship with the Indians who supplied them with their first corn. Although the Quakers were not hunters, they were in a country that offered quail, rabbit, squab, squirrel, wild turkey, geese, duck, grouse, and deer. There were all kinds of salt water fish, shell fish, and turtles; in the streams were plenty of bass, perch, and trout. Amid the forests and open areas of this prolific land grew large crops of cranberries and blueberries for which production New Jersey still ranks high.

New Jersey came to be known as the garden state. The soil was fertile and yielded good crops of grain, vegetables, and fruit. The Quakers soon were raising beef, pork, and poultry. They also had butter, cheese, cider, and honey. The hills of the country afforded opportunity for pasturage—dairying and sheep raising. New Jersey was a happy choice of a food land for the Quakers.

The Swedes

The Swedes were a strong, industrious people; their first settlements along the Delaware were established in 1638. The early settlers were fur traders. But twenty years of friction with Dutch fur traders of New York ended with the Swedes giving up the fur trade in 1655. They then turned their attention to fruit and tobacco raising and small farming. The soil was fertile and the grazing was good. Moreover, there was a home market in Sweden for their tobacco.

The Swedes were successful as fruit growers as well as with their gardens of beans, peas, cabbage, and parsnips. Their favored cereal was rye but they also grew barley, maize, and wheat in the colony. From the Indians they purchased fish, geese, and wild turkeys. Occasional expeditions from Sweden brought cattle, horses, goats, and sheep. Their menus included cheese, melons, rye, and wheat bread. Beer was an approved beverage and excellent wine was made from the native grapes. The colony had an abundance of cow's and goat's milk, and shell fish were available for the digging.

The American Frontier

The traditional diet of the American frontier was game, "hawg" and hominy, cornmeal mush, beans, peas, molasses for sweetening, cider for drink, and bear oil for frying. Surplus corn usually was distilled into whiskey.

An outstanding feature of early farm life in America was work, hard work, for every member of the family. It was taken for granted that the farm had to supply virtually all the needs of the family and, if possible, a surplus. Farm life in colonial America instilled a sense of responsibility into the youth of the farm.

The harsh frontier life required certain characteristic qualities in people of the frontier such as love of freedom, self-reliance, industry, initiative, ingenuity, optimism, and resourcefulness. It therefore appealed to men with these qualities. In the three hundred years of American frontier life, these same qualities were projected into American society and institutions.

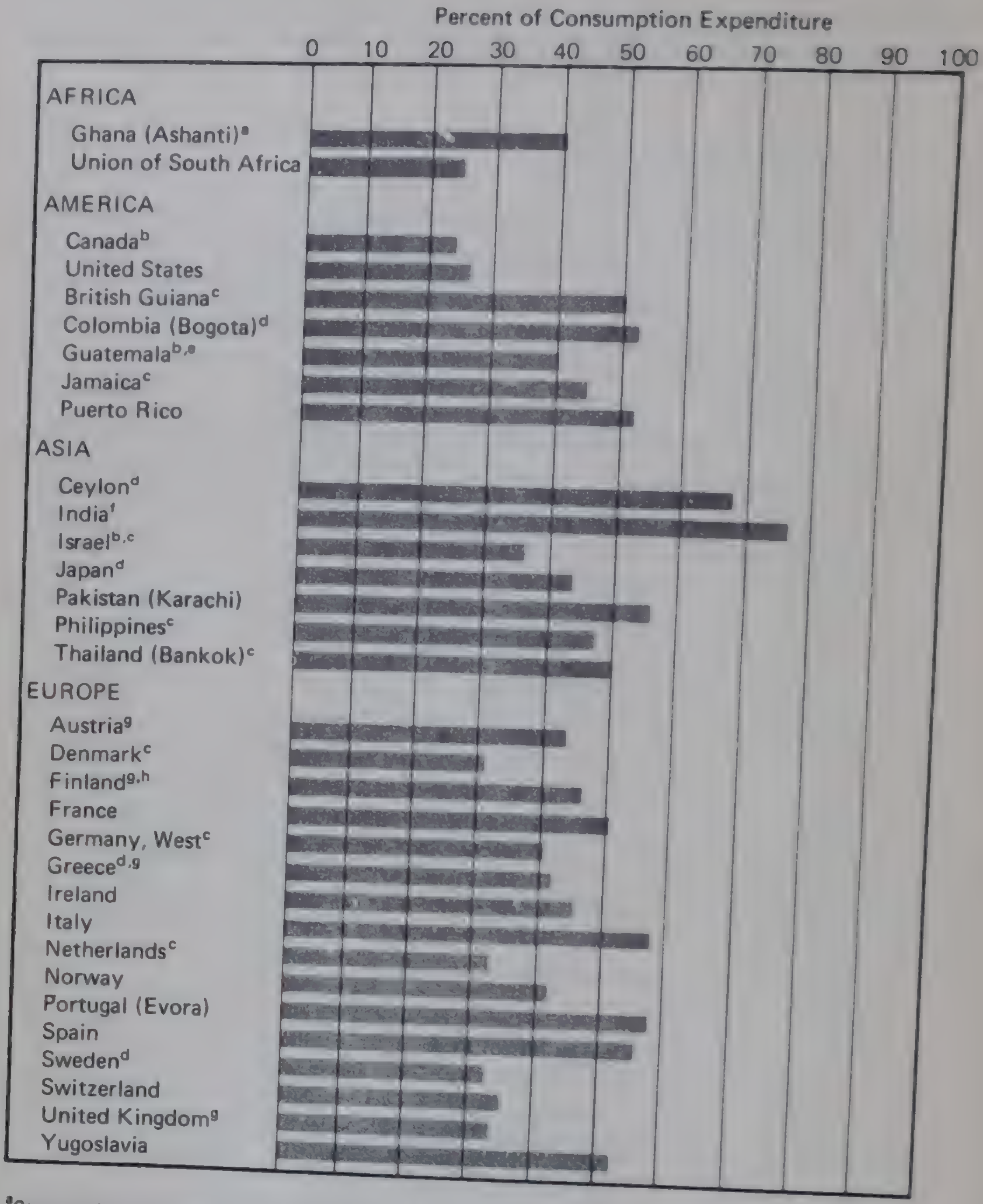
CONTEMPORARY AMERICA

An abundance of food always has been basic to American life. The early settlers capitalized on the potential wealth of the fertile land and favorable climate through the production of needed crops and then of surplus crops. During this period, land was all important and trade of the natural resources of the land was the great attraction. However, abundant physical resources do not automatically produce the unprecedented wealth that America has. As Potter states in his book, *People of Plenty*, 1954, "The social value of natural resources depends entirely upon the aptitude of society for using them." The year 1862 marked the establishment of the land grant colleges and the United States Department of Agriculture and the passage of the first homestead act. These events actively participated in the establishment of a unique American food production system.

After the farmer was producing a surplus, access to the market became a prime concern. The population was increasing; food had to be transported out of the rural areas to feed the urban populations. Food was also important in earning foreign exchange and in minimizing the foreign exchange bill for food Both the federal and state governments made this access to market available by constructing the Cumberland Pike and the Erie Canal and by financially backing private interests as in the building of the transcontinental railroad. The wealth that was earned by the surplus was saved and invested.

Because of the largescale concentration of capital and labor the potential of hydro-electric power, coal, petroleum, copper, timber, and iron was able to be tapped for its great wealth. The large capital was made possible by the practice of incorporation. New techniques of agricultural production were found. As a result of land, labor, capital, entrepreneurship, and the effort of the American people, a rapidly advancing technology came into being. This technology was the stimulus for the "take off" into self-sufficiency. The frontier is no longer agrarian. Instead, as Potter aptly states, "the frontiers of industry, of invention and of engineering have continued to bring into play new resources quite as rich as the unbroken sod of the western frontier."

Food is of prime importance in the industrial economy. The food industry is America's biggest business. It employs over one-quarter of all working Americans. General wage and cost levels are determined by food. The stability of our currency and the growth potential of our



[a] Cocoa producers' families
[b] Person consumption expenditures
[c] Manual and nonmanual workers' families
[d] Urban population
[e] Wage and salary earners
[f] Agricultural workers' families
[g] All types of households
[h] Rural populations

Comparison of percentages of total expenditures absorbed by food expenditures in the United States and other countries in recent years. (Adapted from: National Industrial Conference Board, *Economic Almanac*, New York, pp. 507–508, 1964).

economy are greatly dependent on it. In 1963, thirteen percent of the gross national product or seventy-five billion dollars went to food. The average American consumed one thousand pounds of food in 1963. In the United States the cost of food in the consumer cost of living index is one of the lowest (see graph).

The present state of economic development reflected in the graph was made possible by the energy, ingenuity, and productivity of the American people. They have been effective in converting the country's natural resources into the present productive capacity, state of abundance, and high mass consumption. The availability of food in America today has no known parallel. The important reasons for this situation are fertile land, favorable climate, technical knowledge, modern transportation, excellent refrigeration, specialized machinery, and abundant electricity.

Cereals

Corn

Corn is the nation's largest cereal crop. three times as many bushels of corn are grown as of wheat. About eighty-five percent of the corn is used for feeding livestock, either as kernels or as the stocks stored in silos for winter use. Corn is the basic ration of livestock.

Wheat

Wheat is the next important cereal as far as quantity grown is concerned; it is the most important in diet. Outside of the rice-eating regions of Asia, by far the largest proportion of the world's population today chooses wheat as the principal cereal food. The degree of economic development of the nation is reflected today in the diet of the people. In affluent America the per capita consumption of starchy commodities has declined. The consumption of calories from sugar and visible fats such as butter, margarine, and oils has increased. The percent of calories derived from starchy foods in the nations of the world ranges from almost eight percent to just less than thirty percent.

Livestock Industry

Cattle Raising

Very early in the sixteenth century, Hernando Cortez, a Spanish conquistador, landed on the Mexican beach near Vera Cruz with sixteen military personnel and a few Andalusian cattle. Christopher Columbus also landed cattle in Santo Domingo on his second voyage. From the stock landed by Cortez and Columbus have come the long-horned rangy animals that now are known as Texas Long Horns. In spite of the head start of the Spanish cattle the three most promising breeds of cattle in the United States today are Short Horns and Herefords, English stock brought to America in 1783 and 1817, respectively, and the Aberdeen Angus, brought from northeastern Scotland in 1873.

The Meat Industry

The part played by the meat industry in the United States would be incomplete without reference to the city of Chicago, which grew from the "wild onion place" of the Indians to the "hog butcher for the world" of Carl Sandburg in a little more than a century. Originally the center of operations for the fur traders and steamboat operators of the Great Lakes, it became the center of the meat and grain trade of the nation due to its location. Today the concentration in Chicago has been dissipated by the spreading of the meat-production industry to several other states.

Americans buy more protein from animal products and less from vegetables. They prefer high-quality, tender, and lean meat from younger animals. Federal government data for 1963 show that 310 pounds of animal protein commodities were consumed per capita per year; of the 310 pounds, 171 pounds were red meat.

Dairying

The art of dairying had its small beginning when man began to domesticate cattle. It has grown in importance with increased human knowledge. Except for cheese, dairying never was a major source of food until recently; today milk and its products have become daily requirements for immense populations. Since the middle of the nineteenth century the growth of the dairy industry has been one of the most conspicuous developments in modern times. Of the entire agricultural income in America from animals and farm crops combined, approximately one-quarter is produced by the dairy industry. This tremendous growth came about as a result of the introduction of machinery during the nineteenth century when there was much new land available for cultivation and when cattle could have ample space and abundant pasturage without reducing the food supply of humans.

Poultry Raising

As recently as the eighteenth century, food was not abundant for man and beast even in America. It is understandable then that there was little left over for poultry. The poultry industry as a regular source of food is a recent luxury industry, a product of the agricultural revival beginning in the nineteenth century. It is a whim of history that the egg is one of the oldest of human foods but the business of its production on a large scale is hardly any older than the manufacture of motor cars. The development of a great poultry industry was impossible until poultry food was available in quantity and until mechanical methods of incubation and breeding were developed.

Market Gardens

A rewarding source of the food supply today in America is the market garden. Certain old plants have been banished from the gardens; others have been abandoned when better varieties have been developed to fill their place. The vegetables from which we developed leading strains were grown by the Saracens in Spain from the fifth to the eleventh century.

Fruits and vegetables rank high on the preference list of the American consumer. They are low-calorie, high-vitamin, high-bulk foodstuffs, and Americans pay a premium to have them out of season. Transportation by rail, truck, or cargo plane provide rapid delivery of fresh produce to metropolitan markets thousands of miles away. Produce from Florida and Texas reach the San Francisco markets in two days and two nights.

Manufacturing

Alexander Hamilton, the first United States Secretary of the Treasury, was interested in developing the manufacturing industries after the revolution. In 1791, he prepared a list of those industries then in operation in the nation. Only one food industry was on that list, sugar refining. Today there are at least six thousand manufacturers of just baking products in the United States.

Preservation

Preservation of food has been a natural urge in all times because it often has meant survival. Drying, salting, smoking, fermentation, and freezing of foods have all made their contribution, as has the use of wine, vinegar, and sugar in combination with heat. All of these have been known since around 3000 B.C. Finally man learned to preserve food by sterilization and refrigeration. Since man had no knowledge of bacteria, he had no idea how preservation was really effected but he learned from Pasteur in the nineteenth century.

For the major part, progress in preservation methods have concentrated on improving existing methods rather than developing new methods.

Canning

Canning was invented in the time of Napoleon. The first food-canning industry in the United States was established in 1817; the first patent on a tin container was granted in 1825. During the civil war the production increased sixfold as the government commandeered all available canned goods for the army. Today almost ten percent of the nation's food is canned and the per capita consumption has been maintained. However, the canning of many fruit and vegetables is being replaced by freezing.

Freezing

In the twentieth century, prepared foods have come into their own. Prior to 1930 no store sold any quantity of quick-frozen foods ready to eat, but experiments in quick freezing had been carried out. Eskimo and trappers who lived or worked near the Arctic Circle always had known that meat or fish left out of doors in temperatures of 40° to 50° below zero froze almost instantly with the natural flavor unimpaired.

The vision of frozen foods in the markets of America appealed to one man, Clarence Birdseye. Much effort went into the development of equipment for freezing, into merchandise display, and into persuading the dealer to stock the food and the public to buy it. The arrival of the frozen food industry of today was greatly aided by World War II. The armed forces required great quantities of canned goods which left them in short supply at home. The public turned to frozen foods and liked them.

Drying

Nuts and grains were sun dried by man before the discovery of fire. The practice of preserving meat by drying undoubtedly came to this continent in the great migration across the Bering Strait thousands of years ago. The Indians hunted deer, moose, caribou, and bear which they preserved by smoking. They sliced buffalo meat or venison very thin, dried it in the sun, pounded it fine, mixed it with fat, and packed it in skin bags for storage or travel. This food was called pemmican. Drying was carried out on a commercial scale in the eighteenth and nineteenth centuries.

Freeze-dried foods today offer great commercial promise. The product is frozen, subjected to a vacuum, and heated to remove moisture. The foodstuff is compressed and weighs very little so dry storage is inexpensive. In another process, dehydro-freezing, the food is first dehydrated to about fifty percent of its original weight and volume; then it is quick frozen. The results of these processes are our convenience foods —instant coffee, dry mixes, cake mixes, etc. These are available in our supermarkets today and are very popular with the consumer.

Developments in the drying process are numerous. Pressure puffing, vacuum-puff drying, foam-spray drying, and foam-mat drying are all important methods for unique food preparations.

Irradiation

Ionizing energy will be applied to foods in the future to extend the food supplies. This method is now used to a limited extent to deinfest grains, inhibit sprouting of tubers, and preserve certain seafoods and meats. The meat remains unspoiled and edible without refrigeration over a period of time. But flavor and color have not met acceptable standards as yet.

Americans and Abundance

American consumers today can have tomatoes from Texas, oranges from Florida, and strawberries from California all winter long. They can have scrambled eggs heat sealed and frozen in polyethylene bags. The average supermarket in affluent America has over six thousand items on its shelves. It offers endless varieties of bakery and cereal products, canned and frozen goods, freeze-dried and irradiated foods, dairy products, fruits, coffee and tea, and sometimes exotic products that please the gourmet. Americans in general prize this variety in their food and consider a monotonous diet undesirable. It is this same variety which ensures a degree of adequacy in the American diet.

The American diet in 1962 averaged 3180 calories per capita per day and ninety-five grams of protein (sixty-seven percent of which was animal protein). Forty-seven percent of the calories was contributed by cereals, potatoes, and sugar; forty percent was contributed by fats and oils.

Behind eating in the United States, health is a prime motive and there is a general drive to be well nourished. This is especially true in relation to parents' goals for their children. Because of the total commitment to abundance, the occurrence of obesity in the population is not surprising Infants are fed cow's milk rather than human, and solids are introduced into their diets by two months of age. American

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Sara Ellen

Abundance in America. The average supermarket has over six thousand items on its shelves. (Photograph by Robert A. Isaacs)

mothers like chubby babies. Chubby babies are healthy babies. Food and health are equated.

The national effort to improve nutrition of growing children is illustrated by the feeding programs of school lunch and Head Start. The recent Food Stamp Plan for people who have inadequate incomes is a result of a concerted effort to raise nutritional levels of consumption.

Foods of low caloric value are gradually coming to be prized because of the obesity problem. Overweight is a problem of children, young adults, and the middle aged. It is of major concern in the United States because of the concomitants which accompany it—atherosclerosis and hypertension.

Among the many uses of food, the use to relieve boredom and tension probably offers partial explanation for the obesity seen today. The hurried or "no breakfast" pattern, with a quickly swallowed and perhaps less savored lunch, may account for the enjoyment of the leisurely heavy evening snacks common to the American pattern of food intake. At the same time heated houses, automobile use, and sedentary work have decreased the need for so many calories. The consumer is faced with the choice of the fruit advised by the nutritionist or the gooey dessert pushed by the advertising world.

Advertising of food in print, television, and radio involves huge expenditures of money and must necessarily be worth its cost. Yet the average United States shopper is a shrewd one who only recently openly protested rising food prices. More and more she reads the labels and the newspaper columns on protection of the consumer. The Federal Food and Drug Administration and the United States Department of Agriculture stand guard over the safest food supply on earth and, in fact, in all history. A minority of this population could be classed as food faddists, because they are willing to pay high prices for unproven values in foods. Mostly they seek magic cures in the foods they eat.

At the present time, food shopping habits are changing in families where mothers work. Today many fathers and adolescent children are responsible for buying the major part of the family's food.

The public reaction to food is now being studied with increasing interest by food-processing companies. Consumer response to flavor or attractiveness in taste is influenced to a great extent by texture, color, and general appearance. Consumers demand quality as well as variety.

In summary, the modern American enjoys his food which he may choose from abundant supplies. He expects his money's worth and, at least periodically, appreciates his very fortunate position. Whether he, in this affluent society, can really understand the degraded lot of the migrant farm worker who harvests this food for him or the protein-starved baby in far-off Africa is the important question.

Yet, traditionally, Americans are generous in giving food and money to buy food for those less fortunate. American Food for Peace shipments exceed the total food exports of any other nation. Under the direction of the United States Department of Agriculture, American agricultural surpluses not only mitigate the hunger and malnutrition of underdeveloped nations but also release food which then can be used for internal development purposes such as payment for labor used in building roads and public works. Donated surplus food may also aid in holding down food price inflation created by the country's own limited food resources. Yet even if all our surplus food was supplied to the underdeveloped nations, it would not assure the elimination of hunger. Aid must be used to generate economic growth so that the underdeveloped countries can "take off" into self-sufficiency. Theobold suggests that a coordinated world food policy is needed in development programs. Nations donating food surplus need to adjust production and trade policies to the needs of these nations as well as their own.

Galbraith warns that the road to growth is not the same for all nations. He classifies countries in accordance with the barriers that are principally operative in preventing their advance. In Model I (countries such as those in Africa), the main barrier is the shortage of trained, educated people. In Model II (countries such as those in Latin America), it is the regressive social structure. In Model III (countries such as India), the main barriers are overpopulation and inefficient use of land and capital. Each model requires a different approach, appropriate to the particular situation. There is no simple solution to the problem. Yet the poverty and hunger of two-thirds of the people of the world exist in stark contrast to the abundance of food and material goods in America; the desire on the part of the "have nots" for social change is strong. As the cry mounts for a better life—for food, for a share of the earth of plenty—frustration increases. Tensions are heightened and emotional pressures build.

Historically, Americans have been concerned with humanitarian principles and ideals of freedom. Today there is a new revolution—the challenge of the poor and the underdeveloped countries. By meeting this challenge Americans may, in the twentieth century, rise to the ideals of their forefathers.

STUDY QUESTIONS

1. What factors were responsible for the difference in the development of the British South and the British North in America? How is the basic character of the colonial people in American reflected in their food habits?
2. Contemporary Americans consume a safe and varied diet. What factors have made this possible?
3. What are some of the stages of economic growth in a developed country such as America?
4. Do these same stages of economic growth apply to all countries?
5. What nutritional problems result from the American total commitment to abundance?

TOPICS FOR INDIVIDUAL INVESTIGATION

1. Compare the value of the grain industry and the meat industry in the United States from the founding of the Union until the present time.

2. Discuss the American character as it relates to the abundance of food in America.

3. Using the foods peculiar to one section in the United States outside the thirteen colonies, show the contribution that the frontiersmen made to that food group.

4. List the foods common in American today that were used by the Indians. Explain how the white man improved on these foods and their use.

5. Discuss the technological advances that are behind the fact that foods in America take less of the total household dollar than they did previously.

6. Choose one of the following countries and trace its technological development in relation to its food supply: Mexico, Japan, Ethiopia, India, Iran, Brazil, Uganda and Nigeria.

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FOOD HABITS AND FOODWAYS

In some parts of the world, grasshoppers and grubs are considered food delicacies; in others, aged beef is worth a high price. Food habits and foodways differ from group to group.

The term "food habits" may have different meanings. We are using it here in reference to habits of a group that reflect the way a culture standardizes behavior of the individuals in the group in relation to food so that the group comes to have a common pattern of eating. By way of illustrating what is meant by a food pattern or food habits of a group, let us examine some things which we think characterize the pattern and use of food in the United States today.

Two extremes are represented in this American pattern. One is the ever-increasing use of "convenience" foods which require a minimum of preparation; the other is the value placed on gourmet foods which are expensive and take great care and effort to prepare.

In a nation as well nourished as ours, foods usually are not eaten just to appease hunger but because

In America, foods usually are eaten because they appeal to the appetite. (Courtesy of Central Soya Co., Inc.)

they appeal to the appetite. For the upward socially mobile parts of the population, status is attained by the foods which are purchased, served, or eaten at the restaurants at which these people entertain. Once an individual in this group is secure in his social position, he may go "slumming" for his food, seeking the alien and exotic in foods.

Americans, in general, prize variety in their food and consider a monotonous diet undesirable. The author has observed that nursery school children usually prefer familiar foods and do not react against a sameness in diet in the same way as adults do. As Dorothy Lee points out, some cultures value sameness of diet and monotony is "good and sought."

Food is abundant and displays are elaborate in the large supermarkets. This type of store now dominates in the retail sale of food. The display of six to seven thousand items in one large supermarket is not unusual; many carry even more items than that. The display of unusual foods shipped from distant places varies with the affluence of the district.

It has been said that food habits depend on a combination of psychological and biochemical factors. Within limits, people do eat what they like and what they think is good for them. Food patterns are based on food lore and, in part at least in a modern, highly technically developed country, on commercial advertising and sound knowledge of nutritional needs. Dr. Jacques May says: "The factors governing human diets can be listed as follows: (1) men eat what they can get from the environment, (2) given a choice they eat what their ancestors have eaten before them." It must be pointed out, however, that what is eaten must be related to the physiological needs of the body or the group of individuals do not survive.

Choices among foods are only made when food is plentiful enough to permit choices. It is common knowledge that food taboos and restrictions are relaxed during starvation. In fact, hidden in the annals of our own history are examples of cannibalism among starving pioneer migrants.

When there is sufficient food so that choices can be made, there develops a set of food habits and foodways with their attendant taboos and prejudices. This is what we propose to discuss here.

CULTURAL BACKGROUNDS

Food habits vary from one cultural group to another because each group, in its own evolution, sets up a complex pattern of standardized behaviors. Individuals within a culture respond to the approved behavioral pressures by selecting, consuming, and using those foods which are available. It is true, therefore, that the food habits of a group are, as Dr. May says, the product of the group's present environment and past history. Those food habits and customs which have become meaningful to the group are carefully held and not quickly changed. It follows, therefore, that anyone who would change a food habit must first understand the deep meanings of the particular habit to the people. Those food habits which do not have deep meaning may be changed rather easily.

Except for people who live apart from other groups, as do the aborigines of Australia and the bushmen of Africa, it must be expected that outside influences do affect the environment. This results in changes in food habits as well as in other patterns of living. Such changes have been seen when white flour and white sugar as well as American canned goods have been shipped into developing countries. When a group is subjected to outside influences, it often has been observed that the older people in the group change less quickly than the younger individuals.

Advertising surveys in the United States have shown that changes in patterns of buying are most easily brought about through appeals to young adults.

It is well known that the emigrant gives up habits of dress and speech before he gives up his native food habits. Food habits are considered more personal than other habits since food usually is eaten in the confines of the home and with the family members. The individual, therefore, is confronted with less pressure to conform to the food practices of the larger group outside his family.

Two excellent examples of the retention of native food habits by several cultural groups living within a confined area, and the consequent blending of these habits into a new cuisine, are seen in Viennese and Hawaiian foods. Poles, Bohemians, Hungarians, Yugoslavians, and Moravians kept their native food patterns when they first migrated to Vienna and for many generations thereafter. Finally, all of their foods were blended into a new cuisine, the now famous Viennese food. Hawaiian food shows the same blending: the sweet potato, the pit-roasted pig, and the many products from the coconut came from the Polynesians; the vegetable and meat cookery from the Chinese; the soups, raw fish dishes, and the rice and seaweed combinations from the Japanese; the curries from India; the pickled vegetables from Korea; and sweets and pastries, soft drinks, hot breads, hot dogs, and expensive steaks from the United States mainlanders. Thus Hawaii has become a paradise for those who are interested in intercultural foods. The food markets, especially the ones with many stalls, are fascinating to "poke" around in to see unusual fish, vegetables, and fruits.

The mark of the immigrant is left on the food habits in every one of our fifty states. Kolachies from Bohemia are found in parts of Iowa; limpa, lutefisk, and lefse, as well as lingon berries (especially at Christmas time) from Scandinavia are common in Minnesota; chile con carne from Mexico is found in Texas; the French bouillabaisse is found in New Orleans; and German sausages are served in Pennsylvania. Some of these foods now are considered almost native to these regions.

Stability of Patterns

Each ethnic group carefully passes on its foodways through the training of the children so that each child knows what is considered to be food and what is not. The primitive African child learns early to prize grasshoppers and grubs as food, as the American child learns to drink his milk. Children also are taught socially acceptable behaviors in relation to food. Thus they come to know what the limits for food refusals are, so the original impulses of children toward the satisfaction of hunger are transformed into socially acceptable appetites.

The mother's direct control exerts an important influence on the eating habits of her children. She may pass on her own dislikes or force herself to eat disliked foods in order to "set a good example." Usually, by fair methods or foul, she attempts to get her children to eat what she believes is good for them. If she buys the food for the family, she is truly the "gatekeeper" for most of the food which comes into the home.

Not everyone in a cultural or ethnic group, however, eats exactly alike. Subgroups form, some small and some large. Differences in food habits arise due to differences in environment such as climate or growing conditions or due to difference in religious beliefs. One of the best examples of this division into subgroups is shown in the variety of food patterns in Italy, in part at least due to differences in growing conditions from north to south.

Group Influences

Sociologists and anthropologists have pointed out that in primitive cultures, with the exception of the most simple societies, the raising and harvesting of foods are often group activities; pride and satisfaction in food production become forces that cement the group together. Individuals cooperate and yield to mutual preferences which are culturally acceptable. In these groups eating together is also intimately associated with the family group. The cooperative efforts and this eating together come to imply a kind of kinship even outside of the family of true blood relatives.

The tendency of a society to have pockets of culture with groups of individuals who keep their own food habits is greater perhaps in societies where communication across a country is not highly developed. In larger cities, groups which move in from totally different cultures may exert potent influences for change and, therefore, cause a change in food patterns. Wherever travel to outside places becomes common, suspicion of strange foods breaks down. The more secure individuals in any group dare to try new foods; in this type of people there is less rigid demarcation in what is considered a proper food.

In many cultures, eating is considered a private affair to be enjoyed within the confines of a family group. There are reports of places where individuals eat away from all others, even family members. For instance, in some parts of Melanesia and Polynesia, men and their

A child eating in India. (Courtesy of The Rockefeller Foundation)

wives lead separate lives; they have separate lodgings, meals, work, and property. There the rule is that men and women should never see each other eat. Among the old Semites, it was not the custom for a man to eat with his wife and children. Sumner in his 1960 edition of *Folkways* reports, that in northern Arabia, "no woman will eat before men" and "there is a widespread notion that one should not be seen to eat by anybody."

In the Sudan, it is said that the practices of eating and drinking in private and covering the mouth when eating and drinking were to prevent the evil eye from affecting the individual. It is thought that this belief originated from the watching of others eating by hungry people who might be envious. Others believe that the homeless evil spirit could wander into their open mouths and cause trouble.

In some countries, workers as well as school children are given long noon hours so that they may go home to eat with their families. In the United States, family members make great efforts to be together for Thanksgiving or Christmas dinner. There is the now oft-told tale of the Greeks, after the World War II occupation of their country, who preferred to take hot soup given to them by the Red Cross to their cold homes to eat with their families rather than eat it in the warm Red Cross canteens.

It is said that in the early middle ages in Germany, after the formal marriage ceremony the spouses ate together as a part of the total procedure of marrying. So the origin of the American custom of the bride feeding her new husband the first piece of the wedding cake she has just cut may be very old.

Ethnic Influences

In the UNESCO book, *Cultural Patterns and Technical Change,* it is pointed out that "where food practices reflect cultural structuring and values, any change introduced into the society may produce imbalance." For instance, knowing the structuring and meaning of meals among the working classes in Japan following World War II, their nutritionists, also knowing the importance of miso soup for the first meal of the day, introduced the idea of adding the extra fat needed in their diet to that food.

Families also tend to develop their own food habits. The attitudes toward food vary in different families, from indifference to excessive preoccupation with food. One of the best illustrations of differences in food practices among American families is the bread stuffing with which the family believes it proper to stuff the Thanksgiving turkey. Some of us know of mothers who find it desirable to put one kind of dressing in the front part and another in the back part of the bird to satisfy the firmly held opinions of her husband and herself. In fact, American feasts often become unnecessarily elaborate because each partner wants a special kind of food that was used in his childhood home such as mashed white potatoes for northerners and sweet potatoes for southerners.

In different ethnic groups, food has different prestige and emotionally satisfying properties. The French, for instance, hold food in high regard and are justly famous for their cuisine; the Italians take great pleasure in eating and family meals. In some cultural groups and families, eating is a matter of duty and is lacking in emotional satisfaction.

In other groups, thrift may be uppermost in the minds of people, even going beyond the requirements of their income restrictions. For some people, the nutritive value or even supposed value for production of health may dictate food patterns. One is reminded of the old story of the daughter whose mother was trained in nutrition. When asked what she wanted to eat, she surprised her hostess in a restaurant by replying "Anything but healthful food. I get so much of that at home."

In some ethnic groups more than others, the women are said to be kitchen-bound or neighborhood-bound. When migrating to a new home, these people tend to settle in neighborhoods where they find former emigrants of like ethnic backgrounds. They spend their lives near where they live, and even shop in grocery stores carrying only foods of their nationality. In some of these groups, of course, change comes about as children go to school and as the young people bring back new ideas. Often, though, the group-imposed idea of marrying one of like nationality tends to preserve the group patterns.

It has been said that cooking reveals the culture of a country and that a country's soul is reflected in its food. For instance, Felix Martin-Ibanez suggests (though some others disagree) that the tendency of the Spaniard for violence and his love of bright color are reflected in the sharp-flavored polychrome *paellas*, that the food of the Japanese reflects their love of order and cleanliness as shown by the array of beautifully cleaned and cut foods for *sukiyaki*. He also believes that the national foods of Britain reflect their aseptic robustness and reserve, while the Gaelic subtlety of expression is shown in their *delicate sauces*. And the earthiness of the Italians is demonstrated in their *pastas*.

Cussler and deGive, from a study they did in the southern United States, believe that of all group influences on food patterns the family exerts the greatest effect. With Renner, they wonder why any food habits change since, as he says, "there is a circle. What one eats when young, that one likes and hands on to one's offspring which should rotate forever."

The Committee on Food Habits of the National Research Council, in their 1945 Bulletin 111, summed up the subject when they said,

> *Another aspect of the way in which edible materials are classified as inedible, edible by animals, edible by human beings but not in my kind of human being, edible by human beings such as self, and finally edible by self. These classifications are further reinforced by various sorts of attitudes—*

Feeding an infant in Madagascar. (Courtesy of Food and Agriculture Organization)

> *"that materials which are not eaten are defiling, wicked to eat, coarsening, would alter one's status, etc."*

We are at once reminded of the derision of Dr. Samuel Johnson that the Scotsman eats oats which should really only be fed to horses. Or remember that corn (maize) was rejected as inedible by human beings by the Irish during the mid-nineteenth century potato famine, as well as by hungry people in Germany in the mid-nineteen forties who said it was only feed for chickens.

What food is considered edible by a group is an important consideration, as was illustrated when a new kind of hybrid corn was introduced into a Spanish–American group. Although this corn gave a yield three times that of the one commonly used, within half a decade these people ceased to grow the new corn because the wives objected to the texture in the tortillas and no one liked the flavor. Edibility, or acceptability, also came in where hungry rice-eating people in India rejected the donated wheat because it was not white like rice.

In the United States many complaints were registered about the gray color of the bread made from the more nutritious and economical high extractions of wheat flour used during wartime conservation of wheat. Large numbers of people the world over feel that the lighter the color of a food, the more desirable it is.

Perhaps we should point out that individual food dislikes and reactions fall between the classes of edible by individuals like myself and edible by self. One person may eat liver, but another finds it inedible. This may be because the two people as individuals taste its flavors differently and react differently to its texture.

Meal Patterns

Cultural and group influences determine not only what foods are eaten, but they also determine the meal patterns, the number of meals in a day, and the methods of eating and utensils used. Travelers in Europe perhaps have watched an American order bacon and eggs and pay a price many times the cost of the European's continental breakfast of rolls and a hot beverage. The habit of having tea even at a business conference in Iran and in India surprises many Americans and sometimes becomes a bit trying to them when, in true American style of rushing about, a busy morning calls for several conferences. The meal hours for dinner at nine o'clock or later, in some tropical countries, often tries the patience of the American tourist, who may find himself the only diner if he eats earlier.

The National Dairy Council has a poster showing different kinds of breakfasts in a number of countries around the world and the time of eating in relation to Central Standard Time in the United States. Miso soup may be a commonplace breakfast in Japan, but when a well-known soup company gave a "Soup Breakfast" at a national meeting, they really got attention.

Although many of us in the United States may believe that the Continental use of the knife and fork is perhaps more efficient and even

A nutritious school lunch in Bulgaria. (Courtesy of World Health Organization)

more graceful, most of us stubbornly cling to what we learned as children. The history of manners for eating and etiquette is an interesting study in itself. Sumner, in *Folkways*, says: "The conquest of the art of eating with propriety was accomplished by the introduction of forks. Before that, the bread was a tool with which to eat, and it required cultivated skill to handle it properly." The dainty use of fingers for eating in Moslem cultures is often amazing to Americans. Even differences in table service, such as when no clean dishes are given to a diner during a many-course Asian feast, sometimes cause Americans to raise their eyebrows.

Methods of eating differ—these children live in India. (Courtesy of Food and Agriculture Organization)

There are also fashions in food and fashions in meal patterns. These may be based on the intellectual approach of the low-calorie breakfast or lunch. In the calorie-conscious food culture in the present United States, it is now fashionable to omit bread and desserts for dinner.

After the urbanization of many Americans made it impossible for the man of the house to eat at home at noon, the heavy meal of the day naturally came to be served at night. Although, quite logically, it could then be called dinner, many considered this an affectation; the name of this meal was often confused with that for light supper.

The usual seems natural to us, and the unusual unnatural or suspect. Yet habits must be given more credit than logic for many of the group customs of foods eaten, of manner of eating, or even times of eating. Ritchie Calder points out that abalone steak is an expensive item enjoyed by gourmets in California, but he doubts that they would enjoy the up to three-quarters of a pound of meat of the large African black snail which has the texture and other qualities of abalone. In West Africa, however, this snail is a festival food as is our Christmas turkey;

no one can be found at home when weather conditions make a large harvest of these snails available.

The staple food of a country usually enjoys high prestige. This is true in Uganda where steamed plantains called "matoke" are a staple food, as is cassava in Ghana and bread in Greece. Poi, made from taro, once was a staple food of Polynesian Hawaiians. Now that it has become expensive and scarce, it is not commonly eaten in Honolulu but is still highly prized and ascribed a nutritive value by some people beyond that warranted by its nutritive content. There is even talk of trying to create a greater market for it by promoting its use as a food for allergic infants who apparently tolerate it well.

INDIVIDUAL DIFFERENCES

In addition to cultural, ethnic, and family influences on food habits, individuals differ, as we all know, from the moment of birth. Good and poor digestion, food allergies and idiosyncracies, the rate of the body's use of food for energy, the degree of intelligence, the extent of the imagination, the effect of education by making the individual aware of the body's needs, and drives such as the desire to attain status all combine to give one individual his own peculiar eating pattern. Mothers who try to feed a family made up of strong-minded individuals are well aware of these differences, as are those whose business involves serving food to the public. Reactions to coffee, good or bad, served by different restaurants point to the fact that the descriptions are colored by more than the coffee brew itself. It has even been found experimentally that some individuals rate the same brew of coffee as weaker when it is served in thin china cups than when served in heavy pottery mugs.

Probably everyone has a unique pattern of food behavior which is shared with only a few others. Individual differences may even obscure the common food habits and attitudes of a shared culture which are brought about in a group by similar physiological makeup and environment.

To summarize group and individual differences in food patterns, we quote from the FAO Bulletin Basic Study number six, "Education and Training in Nutrition." It says:

> *What people are willing to eat is determined by a complex system of attitudes, ideas, and assumptions that form the local cultural patterns. These include religious restrictions, taboos, ideas pertaining to the merits or demerits of a food, and other attitudes which are as yet little understood.*

OTHER INFLUENCES

Geography

In addition to the other factors we have been discussing, it is well known that geography exerts a fundamental influence on food patterns. Although the inhabitants of Puerto Rico and Hawaii come from entirely different ethnic backgrounds, there is a great similarity in the tropical fruits used in each of these countries. The similarity of the diets of New Zealanders and Danes, living half a world away, has often been pointed out. The generous use of dairy products by each of these people must be, in part, a function of their climate, growing conditions, and topography of the land. Where rice and not wheat flourishes due to the water soaking of the lands by the monsoon rains in Southeast Asia, the people are rice eaters. The introduction from the New World of maize into sections of Africa and of the potato into Europe where the climate favored their production brought about fundamental changes in the diets of the people.

Sugar cane, now cultivated in many tropical countries, was said to have been brought by early travelers from India. The liberal use of pineapple, even in iced tea, and other tropical fruits in Hawaii at once suggests the influence of climate and geographic conditions on food habits. Where else will wild huckleberries be so commonly eaten as in the mountainous areas where they grow abundantly, or salmon be such a favorite food as in the water-surrounded Pacific Northwest and Alaskan coastal area?

Climate and seasonal production also affect food habits, especially when methods of preservation and storage are not highly developed. In many places, foods can be eaten only in season. In parts of the Near East, grapes and figs, although abundant in season, can be eaten only during two months of the year.

Technological Development

Technological development exerts a pronounced influence on food habits and is one of the strongest forces causing change. The introduction of the freezing process for perishable foodstuffs profoundly affected our use of canned and fresh vegetables, fruits, and meats. The development of refrigerator cars also meant that fresh fruits and other foods from faraway places could be sold cheaper. The American housewife with a freezer ample for storage also can reduce the number of her shopping trips. Where adequate refrigeration has come within the reach of a majority of families, frozen foods have suddenly become popular. This food preservation method makes it possible for a well-known United States brand of frozen chicken to be served at a Sunday dinner in the hills of Accra, Ghana, as happened to the author in 1959. Perhaps it should be pointed out that the introduction of these necessarily more expensive convenience foods into a developing country only widens the gap in foods used by high- and low-income families. Air transportation has also changed food patterns, as evidenced by the foods now available in Alaskan markets as well as by papayas from Hawaii and native fruits from New Zealand in West Coast markets.

Technological developments are, of course, basic to the production of enough food for all the people in a country. The reclamation or better use of the arable land, the use of fertilizers, the making available of needed water, the supplying of good seed, the improvement of the methods of sowing, the use of improved cultivating and harvesting equipment, the provision of adequate marketing facilities with money for seeds and machinery, and the development of facilities to distribute the food produced all profoundly influence the foods available to a people.

The kind of transportation also markedly affects food habits. The Egyptian who never travels may never taste citrus fruits even though he lives only a short distance from where they are grown. In India, the millet, wheat, and rice grown in different regions of the country are not available in other parts, even though the people from different sections might use the other grains.

For the fortunate people who live in technically developed countries, a worldwide diffusion of foods is taking place due to the increased ease of traveling and the possibilities of air transport of foods from one country to another, as well as purposeful transportation of seeds, plants, and food animals. The men of the armed forces who have known the foods of Korea, Vietnam, and other places in Europe and Asia often come to like them and want them when they come home.

Food patterns are also affected when traditional methods of preservation are lost and new methods not yet developed.

Economic Aspects

As is readily apparent, economic aspects are of primary importance in determining foodways and food habits. For many developing countries, economic aid from the more fortunate countries is a necessity so that all the people may have enough food to survive and thrive.

Some twenty-five years ago, Lewin and his students found, in their

Facilities help determine the kinds of food eaten. Foodways are affected by technological and economic factors. (Courtesy of the Upjohn Company)

studies in Iowa, that money was uppermost in the mind of the food shopper. The protest marches of the housewives, disturbed over the rising food prices in 1966, showed that money was still a primary consideration. Wherever money to be spent for foods is limited, the people use more cereals and starchy foods than animal foods and fruits and vegetables. So whether meat or potatoes forms the basis of national dishes depends on the affluence of the society.

When rural families move to an urban area, where the traditional food pattern is upset and where money is the principal consideration, the former adequate food habits may be replaced by poorer ones. Often the introduction of a money-based economy upsets a fairly adequate traditional pattern of eating. In some primitive economies, there are no rich and no poor because all share the available food equally. The stories of the hunt for meat and search for vegetables and water-containing foods of the African Bushmen, where all in the tribe share equally, come to mind. Of course there may be, here as elsewhere, some preferential treatment for those who distinguish themselves in getting the food.

Descreasing the cost of the food is an important way to increase its use. The great increase in the use of frozen orange juice within the past fifteen years illustrates this. In 1950 the yearly per capita consumption of frozen concentrated orange juice was 10.8 pounds; by 1965 this use had almost tripled to 29.6 pounds per capital. Whole citrus fruits consumed increased more slowly.

Thus, in summary, foodways arise within the limits of the geography of crop and animal production possibilities, the state of technology available, and the economics of a group. Specific food habits are suited to the situation and influenced by religious beliefs and taboos.

Before we leave the general subject of the influences on food habits, we should perhaps state that these habits are often classed as good or bad according to whether or not they lead an individual to take a nutritionally adequate diet or not. Because, in this book, we have not chosen to discuss the fundamentals of the science of nutrition, we are leaving the discussion of the biological merits of food habits to the many excellent books on basic nutrition which are available.

USES OF FOODS

Perhaps we can understand the background of food habits better if we look a bit deeper into how food is used.

The primary use of food is always to satisfy hunger, and secondly, to satisfy the needs of the body for growth, maintenance, and energy. These we choose to call the nutritive uses of food because nutrition of the body is involved here. Dorothy Lee says:

> *Culture may present food mainly as a means of the stilling of hunger, or of getting nutrition, or as a way to psychosomatic health; it may regard eating as a duty or a virtue, or as a gustatory pleasure, or as a social or a religious communion.*

However, we make many other uses of food. Food is used to promote friendliness and social warmth or, as it has been called, the ritual of hospitality. Or we may say that food is used in many ways to promote interpersonal acceptance. This becomes so strong a motive that most of us offer food or drink quickly when friends call. A relationship develops between the giver of the food and the recipient. In fact, we all accept food more readily from our friends than we do from strangers because it is easier to develop a relationship with friends.

The common use of food as a gift varies from a neighborly present

An East Indian rice table being served in Holland. (Photograph by Philip Gendreau)

of homemade bread to the elaborate and expensive packages, often of strange and unusual foods, given at Christmas time. Foods, the purpose of which is to signify friendliness, are usually choice or especially attractive or perhaps rare, exotic, or fraught with nostalgic memories. At Christmas time the advertising pages of gourmet magazines are filled with pictures and descriptions of expensive macademia nuts from Hawaii, of genuine aged Smithfield hams from Virginia, of frozen steaks from the corn-belt at four dollars apiece, of live lobsters from Maine, or of Black Sea caviar. On the other hand, the home magazines display and explain in detail how the homemaker can make attractive gifts of inexpensive foods in her own kitchen. Whether the food gift is expensive or homemade depends on how and by whom it is used.

In some societies, homemade food products are considered inferior; to these people processed and packaged foods are considered items worth giving. To others, homemade foods are considered especially desirable. Gifts of foods, however, are always considered delicacies by the giver and are not staple items of diet; the filling of a need even seems to negate the spirit of the gift. Christmas baskets for needy families are usually better received if some unusual foods for a treat are included.

The prominent part food plays at funerals and during the days preceding the funeral is well known. As a visible offering of sympathy, often our first thought is to give the grief-stricken family some food.

The importance of inviting newly made acquaintances to eat in our homes is recognized. It has been said that to eat with a person is to say, "I am your equal." The tension felt by many a young wife when she first invites her husband's boss and his wife to dinner, and the extent of her efforts to provide the best meal she can, are mute evidence of this. Will they accept? Will they like our kind of food? What shall I prepare? Am I equal to making a satisfactory menu? Will I be able to make the food good enough? What will he talk about? Will he be a friendly guest? I wonder what she's like?

All of the restrictions of the hierarchy of dining rooms in a business, government firm, or hospital have some of this philosophy of equals eating with equals behind it. Who can eat in the executive dining room? Perhaps guarded secrets are kept by this closed system, but it must be admitted that there is still the philosophy that only equals eat together.

It is well known that the barring of Negroes from some restaurants has caused some of the worst race riots. As Harry Golden said, it is only when people sit down together in a restaurant, at a family table, or in a schoolroom that they must do so as equals; standing together usually has not caused trouble. In some societies, social class is a greater barrier to eating together than is race.

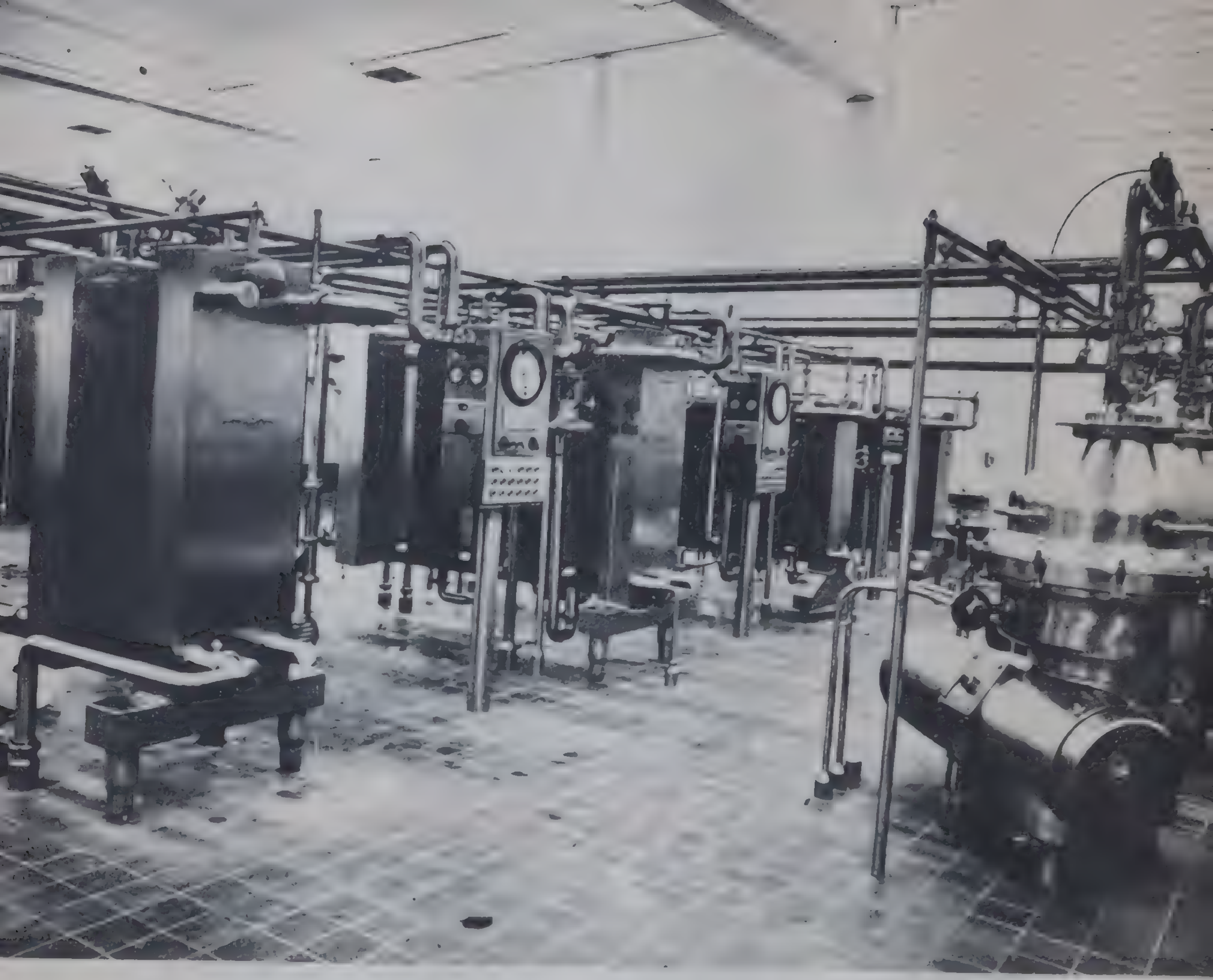
Many people working in different aid programs, such as the Peace Corps, have found that the local people are especially sensitive to the behavior of the outsiders when they are invited to eat in local homes. It is said that the American refusing to eat the prized sheep's eye at a Near East meal can undo much former work to cement friendship.

Many hostesses enjoy giving outstanding dinner parties and use this as a means of creative expression. On the other hand, some extremely wealthy people give great parties to keep their names in the public press. This is not new, for it is said that when the Roman Lucullus (for whom Lucullian feasts were named) realized that his wealth was nearly dissipated and that he could no longer continue to give his splendid parties, he splurged one last time and then committed suicide.

It is equally true that we accept foods from our friends most easily, and suspect and reject food offered by enemies. The latter was especially true in early times when royalty were always threatened by their enemies that they always had their tasters whose job it was to test whether the food had been poisoned. The closing of many German restaurants during World War II was necessitated by these strong feelings.

Attaining Status

One use made of food, as has been suggested previously in this chapter, is to attain status. Food is often used to promote an individual's or



Processing equipment in a milk-processing plant. (Courtesy of Alfa-Laval International)

group's welfare. It is said that in Ruanda the Urundi keep cattle not for meat or milk but as a bank account, a symbol of family wealth. The improvement of status rather than friendship may even be involved in gifts of food or invitations to meals. Those who strive to climb the social ladder, advancing also their economic status, shun the foods of the poor. Nothing less than the best steak is offered. Some people try to build a reputation as gourmets by serving exotic foods. These may be even infrequently liked, expensive, and difficult to prepare; excellence of flavor may be sacrificed for the visible signs of the unusual. In some groups there is nothing to indicate that this is unacceptable social behavior.

Achieving Security

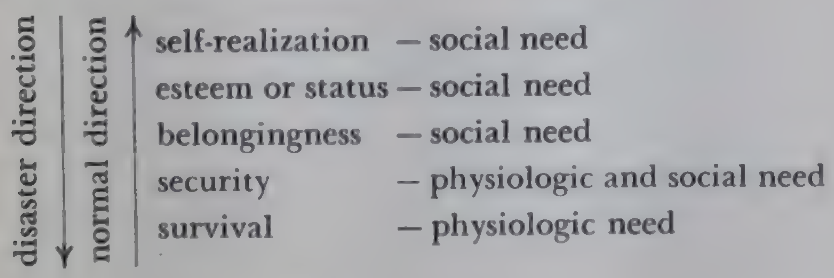
Closely associated with the uses of food to promote interpersonal relationships and to raise one's status is the use of food to promote security.

The individual, as explained through the Maslow theory (see below), who knows where his next meals are coming from, is on his way to acquiring security. A feeling of security is associated with orderliness or a lack of anxiety and tension over whether food will be forthcoming. Certain foods foster security more than others, even apart from their ability to satisfy hunger. For many people, milk is the primary security food. Many of us watched the Red Cross handing glasses of milk to soldiers returning from the Asian Theater of World War II almost before they had come off the gangplank. The eagerness with which these men—long deprived of family and familiar foods—took this milk gave ample proof of its meaning to them. Harriet Bruce Moore says: "The unhappy, suffering, far-from-home-and-loved-ones soldier looks back to *milk* as in many ways expressing the comfort, security, and contentedness of life as it was at home." Milk, because of its association in early life, may foster security for some; but other people, when questioned, name foods such as potatoes or meat. Sweets must have a rather deep meaning for many, as evidenced by the liberal use of them during times of tension.

In times of crises, familiar foods are even more highly valued. During World War II the quartermaster's corps conducted extensive research to determine the meanings of specific foods to the men in the Armed Forces. The value of food in maintaining morale was well understood.

During the summer of 1966, the author asked a class at the University of Hawaii what food signified security. The immediate answer was "rice." As is well known, the Chinese and Japanese predominate ethnic groups in modern Hawaii. These students then told of the hoarding of rice when a shipping strike threatened to reduce its importation.

Perhaps discussion here of the Maslow theory of human maturation would be helpful. Dr. Maslow classified all human needs into the physiological needs (the survival needs) and into the social needs, that is, the belongingness and love needs, the esteem needs, and the self-actualization needs. The idea behind this theory of human motivation is that a minimum satisfaction of a need is necessary before the person can move on to seek satisfaction of the next need in the hierarchy. Perhaps a diagram of this will help.



self-realization — social need
esteem or status — social need
belongingness — social need
security — physiologic and social need
survival — physiologic need

In applying this theory to the use of food, we can readily see that only when a person has food to satisfy hunger can he be interested in any other meaning for food. At the survival level, food is on the "immediate" or "now" basis; interest in "me" is the most fundamental survival need of all.

When an individual has enough food to satisfy immediate hunger, then, and only then, can he be interested in his next meal. Security, as we have said before, refers to a storing of food so that future meals are assured. As the economic situation of the individual improves, he may move upward in the satisfaction of his food needs. Yet in times of disaster, he becomes anxious over his future food supply. The hoarding of sugar during or just before food rationing went into effect during the World War II period is proof that people are soon brought back to fear for the security of their food supply. The overloading of cupboards, pantries, and freezers in American families perhaps may be traced to this motive and gives evidence that the need has not been fully satisfied.

Going on with this hierarchy of needs, food and meals are often used to promote interpersonal sociability which does, it must be admitted promote belongingness. Members of closed groups carefully guard their food habits to remain "in" or "get in."

We have already discussed food to attain or maintain status; promoters of contests to see who is the best cake or cookie baker in the country must be well aware of the strength of this motivation.

The stage of self-actualization, self-realization, or, as we prefer to call it, the creative stage can only be attained when security and belongingness and status are no longer dominant drives. At this stage the individual dares to make up his own recipe, to serve exotic foods,, and to indulge in complicated procedures of food preparation. Townsend's statement nearly forty years ago (1928) expresses what we are trying to say. He said: "The educated cosmopolite does not hesitate to try strange foods. Not so, the savage, the child, the ignorant. In these three classes, food prejudices often curious and irrational abound." Perhaps we should add that the savage, the child, and the uninformed are not secure in their sense of belonging, nor have they attained a fixed status among their often hostile associates. Therefore they dare not be different in what they eat. Children who have unusual foods at home are the most venturesome in trying new foods at school. There probably is no age limit on being a gourmet if one dares to be one. Evidence of the increasing popularity of foods from other countries probably bespeaks the fact that increasing travel increases belongingness and raises self-esteem, perhaps even gives great satisfaction to the security need.

The arrow pointing downward in the hierarchy of needs diagram was put there to remind us that our surplus food in an affluent society could be wiped out in a disaster such as a nuclear holocaust; we would then be brought down rapidly to the survival stage. One is reminded of the letters-to-the-editors and popular opinions expressed in the press several years ago when there was a campaign to stock bomb shelters with food. Some people said they would not hold responsibility for any except their own families.

Relieving Tension

That food often is used to relieve tension is commonly known. Research has shown that as many as seventy-five percent of the group studied said that they ate more when under tension; the twenty-five percent who tended not to eat under tension admitted that they *sometimes* did use food to relieve boredom. This use of sweets, even in young children, is well known. Such a dietary habit has been credited by some to be basic to the problem of obesity in the affluent countries. The fact that from one-fourth to one third of many people's calories come daily from snacks may result not so much from hunger as from relieving boredom or tension. It should also be mentioned that increasing interpersonal sociability certainly plays a part in the heavy snacking pattern of Americans.

Influencing the Behavior of Others

Another use of food is to influence the behavior of others. We discuss later the expression of a mother's love for her family through the preparation of food. It has been sarcastically said that the mother who is angry may serve liver, spinach, and bread pudding, but when she wants to "butter up" her husband or her family, she may serve steak, baked potatoes, and ice cream.

Sweet foods often are used as rewards, even as a personal reward when "I've written through a long, hard day." Generations of children have been admonished to eat their vegetables so they can get their desserts. Some physicians even give a child an all-day sucker for being a "good" boy.

Young children learn very early that to eat or not eat their food is an easy way to elicit a reaction from anxious parents. In fact, many children are past masters at controlling adults through their eating. Food also can be a powerful weapon for punishment, either by the withholding of eagerly sought food or the forced eating of unwanted food.

Adolescents often find the use of food a good way to express rebellion. Many people who work with this age group believe that some overeating, with the resulting obesity, is the result of such parental conflict and the child's rebellion.

In business, clients are sometimes entertained with expensive and luxurious meals. This makes it difficult for the client to refuse a request. Some commercial companies have made a rule that food and drink may not be accepted as gifts from customers or prospective customers. The reason for this is obvious.

Expressing Creativity

Although we have mentioned creativity several times in relation to food, it probably does warrant more discussion. Whenever man's hunger and his need of food for security are both satisfied, he then dares to use his creative abilities in preparing food. He tries new foods and combinations of them.

The history of the Romans is replete with excessively extravagant feasts for the wealthy class. The development of complicated methods of preparing food, in history and in modern times, often puzzles the student. Perhaps the fact that everyone eats, except in fasting, and also that food is an intimate part of daily life leads some to degrade food preparation as a lowly task. Yet chefs of renown and those who can create beautiful and delicious foods are well rewarded in most modern societies.

It must be admitted that cookery can be an art, else why were 206 new cookbooks published in 1965, and why did the cookbook that topped that list in sales sell nearly twelve million copies during the first year? In late 1966, *Time* magazine (November 25) used a cover picture and story on Julia Child whose TV cooking program had become a rage. Many of the newly published cookbooks are written to appeal to those who want to be creative in food preparation.

Mothers often show their impulse to create or to show love for their family through food preparation. They prepare an especially delicious dish, serve a meal of a meaningful pattern, or have an appropriate food for a special occasion. Families come to expect a particular food on special occasions, and deep meanings thereby come to be attached to it. Thus the love of the mother is associated with certain foods, and these are often lifetime favorites in spite of the children's wandering far from the parental home.

SYMBOLISM AND PRESTIGE FOODS

A complete body of symbolism has surrounded foods both in historical and modern times. Bread, commonly called "the staff of life" in societies where it is a staple food and not just an accompaniment, assumes high prestige. In some of these cultures, bread is used in religious and social rites; it is placed as an exhibit or decoration at a banquet. In the Lord's Prayer, we say, "give us our daily bread," meaning all food. An old proverb says, "as good as bread." In groups where bread is highly regarded, even crumbs are precious and always are carefully gathered up when they fall on the floor.

The story is told of a group of United States senators each being given a loaf of bread as they left a Greek island by boat, and of the great insult inflicted when one threw his overboard because he felt he did not need it.

Nizzardini and Jaffee, writing in the mid-1940's on Italian food patterns for the Committee on Food Habits, said that in this group where Italian bread is eaten every day and every meal, an emotional tone surrounds it. These people consider it wrong to waste any food but sinful to waste bread; and the *thrifty* housewife gets this appellation because she uses much bread rather than other accompanying foods.

Bread, it is agreed therefore, is a prestige food for some people. In some cultures it must be white to enjoy the highest prestige. White sugar also has enjoyed a long history of prestige. Meat is a prestige food with many people. Roast beef in England was long regarded as food for land owners and rich men, so it was small wonder that ration points were carefully hoarded in war time for the Englishman to buy his Sunday roast. Even now in the United States, roast beef and steak dinners often command and get the highest prices at most restaurants.

In some cultures, certain foods are supposed to have magical qualities and be influences either for good or evil. Not all of this association is from primitive cultures or from early times. Even recently, those who opposed pasteurization of milk were heard in public testimony to endow *raw* milk with the ability to turn gray hair back to black.

Certain foods, like the fertilized duck egg which is regarded highly by some groups in the Philippines, are said to possess aphrodisiac qualities and thus affect sexual desire and potency.

It is a rather common belief, though untrue, that visceral meats are less "energy giving" than muscle meats. Many Americans have a revulsion concerning eating the brains of animals.

A discussion of the meaning of food cannot bypass the question of food taboos. These taboos usually surround animal foods such as meat, eggs, fish, and milk. Many of these culturally imposed dietary restrictions are connected with sex and reproductive function. Some foods are taboo for women, some for boys just entering adolescence, some for fathers or prospective fathers. There are numerous tribes who place restrictions on menstruating women even coming in contact with some foods. Many of these restrictions concern milk and cows whose welfare is thought to be inimical to that of women. There are also restrictions concerning the foods pregnant or lactating women may or may not eat. The old Chinese custom of presenting the new mother with a gift of bones which had been boiled in vinegar and which gave her an edible form of calcium had great merit.

Some taboos may have been based on valuable experience, whereas others have arisen from superstitions, myths, and folk tales. In his *African Notebook*, Albert Schweitzer presented cases of individuals who unknowingly broke taboos and died within a short time.

Another aspect of foods is interesting to contemplate because it is related to the symbolism of food. Norman Cameron, in *The Psychology of Behavior Disorders,* says:

> *Our language is full of ambiguous illusions to social acceptance and rejection, to verbal assaults, to gastric need for food, and to the spiritual need for sustenance. Thus we eat our words and swallow our wrath, the Lord spews us forth, we sink our teeth into a problem, drink in a message, find an explanation indigestible, and reject it with biting comments. When the human being, with all of his verbal ambiguities in his behavior, becomes confused, he often acts out as social operations what was intended to be only verbal metaphors.*

In many ways our English language would be poorer did we not use words basically concerned with food and eating where there is no connection with food. Dr. Harriet Bruce Moore says:

> *Every one has 'his taste' and from infancy until death he concerns himself with seeking and enjoying the kinds of food that are most pleasurable to him.*

She goes on to explain this need by the frequency and naturalness "with which we use our eating sensations to categorize and describe other experiences." She sums this up thus:

> *We speak of 'taste' in many areas of flavors to describe people and situations—spicy, flat, sour, sweet, delectable, and so on. We speak of sensation associated with food—of coolness, bland, tart, smooth as cream, an oily personality, and so on.*

We also tend to categorize our foods in ways only some of which have rational meaning. The meaning of the terms "hot" and "cold," when applied to foods of such people as those of India, are difficult for an American to fathom or connect with his use of the term hot meaning spicy or hot in degrees of temperature. Foods such as meat are said to be strength giving. Foods are luxury or essential, primary or secondary, farm or store foods. The latter terms were used more formerly than they are now. Some foods such as peanut butter, milk, and cooked cereals are children's foods, while steak, potatoes, and pie are men's food, and casserole dishes, salads, vegetables, and cakes are for women.

The meanings of food are usually consistent and stable within a group, and the individuals in the group understand these meanings and make the same interpretations.

The symbolism of salt is one of the fascinating stories in all lore concerning food. It has been said that since it is man's earliest condiment, the hunger for it is almost universal. It is well documented that human settlements were made close to the sources of salt. Some primitive peoples obtained a salt mixture from ashes when they could not get salt from mining it or evaporating sea water. Many North American Indians, who were unfamiliar with our salt, used alkaline potash instead. The word salt is derived from the Greek word for "sea." Homer refered to salt as "divine' 'and separated those nations which knew salt from those which did not.

Once salt was used, it was eagerly sought and even used as money. The Latin word for salt is "*salsus*;" the word salary (*salarium*), which comes from the same root, indicates that salt was indeed at times used as a form of payment. The Roman salt cellar was the symbol of hospitality and friendship. To be seated "above the salt," that is between the salt cellar and the host, was to be honored. In ancient days, salt was used as a form of purification, as a medicine, and in embalming after death. Wars have been fought for salt rights.

Pepper also soared in ancient times to heights of fame, and reparations after wars often were made partially in payments of pepper.

Jean A. S. Ritchie, in 1950, in her classic presentation in the FAO Bulletin, *Teaching Better Nutrition*, has summed up the cultural significance of food. She says:

> *Because of its fundamental role in the struggle for existence, food has acquired a significance in human society, beyond that of providing nourishment for the body, which is reflected in many patterns of human behavior. Food may be closely associated with feelings of security and prestige. It has*

> *an important place in religious observances. It is linked with countless superstitions and prejudices. Thus, it can arouse many emotions—pleasure, envy, confidence, and even violent fanaticism. Their relationships must be taken into account in attempting to alter food consumption.*

Jennie I. Rountree says it just a little differently:

> *Food is eaten for enjoyment, for emotional release, for social prestige, and for attention, adverse or otherwise. Food is refused because of such unconscious emotions as the pleasure of paining others and showing self-assertion.*

Poppy Cannon, in an article in *Saturday Review* entitled "Revolution in the Kitchen," says:

> *Never was a cliché more fatigued—or truer—than the one that bids: Tell me what you eat and I'll tell you what you are. Not only biography and genealogy but the whole field of anthropology could, if one knew the code, be deduced from food. Food is a mirror that reflects a thousand phases of personal, national, and international history. Geography is reflected in the food; so is climate, the local flora and fauna, religion, superstitions, and taboos; wars, victories, defeats, invasions. The food remembers where people traveled, who their grandmothers were, and from what part of the world their ancestors hailed.*

FESTIVALS AND FEASTS

The story of a people could also be written in terms of their feasts and those who attended the celebrations. In general, feasts have been held from pagan times until now to:

1. Celebrate a particular religious event.
2. Celebrate a harvest in the fall of the year.
3. Offer appeasement and glory to a god at the winter solstice when in early times the people feared the sun would desert them.
4. Bless the sowing and celebrate the bursting of spring.
5. Honor the dead and pay homage to ancestors.

Other feasts, peculiar to one cultural group or nation, celebrate certain important national happenings such as the winning of independence. Certain foods come to be associated with each type of feast. Thus, at the time of harvest festivals, traditional and meaningful foods are used. Wild turkeys were used by the Pilgrims in Massachusetts as perhaps their best fall source of meat. This set a precedent for us in the United States in the use of turkey for our Thanksgiving dinner. Long before the Christian era, our present harvest festivals had their counterparts in pagan countries where the gods of the harvest were worshipped with curious and varied rites. Although we in the United States may think of Thanksgiving as our special festival, practically all European countries have a similar one. These are celebrated there more frequently in the rural than in the urban areas. When the President of the United States proclaimed Thanksgiving as a national holiday, it became more of a national festival than it is in most other countries.

In the old calendar the sign for the winter solstice was a circle with a dot in the center. This represented the sun. A symbolic cracker, called a bretzel or pretzel, was made at this season in the form of a circle with a cross in the center to represent the four seasons. The present pretzel is somewhat of a variation of this original form, but no longer is this food used so symbolically, at least in general.

Many winter holidays are gay with lights as well as foods as is St. Lucia Day in Sweden, Divali in India, and the religious holiday at Christmas all over Christendom. Often a meat fairly heavy with fat, such as goose, forms the traditional food for Christmas. Foods which take long and loving preparation are used in many countries at Christmas and other winter festivals. In Virginia, which we are reminded has been "Christmas making" for three hundred and fifty years, the ways of celebrating are as steeped in custom as are the mince pies in spirits. Mince pie, a Christmas food in England since ancient times, is made from ingredients from the East which symbolize the gifts of the Wise Men to the Infant Jesus. The name, at first "shrid pye" or "shredded pie," later was changed to "minced or mince pie." At first these were made in the form of the manger. It is said that when the upper part or upper crust was solid, it was called the coffin. But when it was cross latticed, it was supposed to represent the hayrack of the stable. Later, mince pies became known as "idolatry in crust" because of their association with the Church of Rome.

The Ukranian housewife sprinkles straw under her best embroidered tablecloth for the Christmas table. She also strews straw on the floor and places a sheaf of wheat in corners of the room. It is said that these rites are very old and may represent Christ's humble birth, but some of them may even date back to a pagan harvest festival.

The use of wine and Christmas turkey fat sprinkled on the Yule log is an old English custom. The Croats and Serbians are said to have sprinkled corn and wine on the Yule log while uttering wishes for an abundant harvest the next spring.

Marian Schibsby, writing for the American Council for Nationalities Services on the old-world Christmas customs of many ethnic groups, told an interesting story of the Armenians. She said that after the Church service it is the custom to make visits; these are known as "hand-kissing visits" because the young folks are supposed to kiss the hands of their elders on whom they call. These visitors bring gifts of fruit: oranges for the women and lemons for the men. Also on that day, children bring gifts of poppyseed bread, pastry, and roast chicken, among other things, to their godparents who reward them with gifts of money or handsome new clothes.

Schibsby mentioned a custom of the Czechs and Slovaks who, like many groups, use December 24 as a fast day. Some groups are admonished not to eat until they see the first star. The Czech and Slovakian children are urged to abstain from food until evening so that they may see the "golden pig," but Schibsby did not say what this is. Perhaps the highly prized baked carp is what they were to wait for. This meal, which takes weeks of preparation, is said to be well worth waiting for. The table decoration is made of dried fruit with loaves of special Christmas bread called *Vanocka* after the word for Christmas, *Vanoce.*

The traditions centering around Easter are similar to those which, in pagan times, honored the Goddess of Spring. The very word "Easter" is said to come from the name of this goddess, Eastre or Ostara. The spring holiday foods are often young lamb and fresh, newly grown vegetables if available. These are symbolic of youth, no doubt.

In many religions, feasts to honor the dead include the setting out of foods which, after the supposed departure of the spirits, are eagerly consumed by the needy living.

Too many feasts may become a threat to good nutrition in several ways. One is, of course, overeating. In some cultures, so much food is saved for feasts that undernourishment in between is common. In general, foods which are used for feasts are:

1. Scarce—which puts a high priority on them.
2. High quality—the best jar of pickles saved for Christmas dinner.
3. Often expensive—which makes them desired.
4. Difficult and time consuming to prepare—where the love of the cook can be demonstrated.

Abstinence from some kinds of foods before a festival has been practiced throughout recorded history in many different settings. Many people abstain from certain foods, usually animal foods, until the first star is seen the evening before Christmas. Abstinence from animal foods before the spring festival is found in a number of cultures as it is in Lent before the Christian Easter. Denying oneself the favored animal food is considered good self-discipline and increases one's devotion to a belief. It has been said that authoritative religions all use the denial of the gratification of appetites in order that one may live above carnal desires and escape the fear of complying with instincts.

It has been said that among the most valued gifts the immigrant groups brought to the United States were their folkways and folklore; to this may be added their foodlore. The best and finest of their customs and traditions associated with their festivals now have become woven into the culture of the United States. It will be a sad day when we lose this color in our life, and efforts should be made to preserve it.

CHANGING FOOD HABITS

As background for this discussion, we would like to reiterate certain universal truths.

Culture has profound effects on human behavior, is very complex, and must not be underestimated; nor is there an easy way to circumvent a culture. However, at the same time, it is not wise to stereotype all the people in the group as being exactly alike. Human behavior is always multiply motivated, and every human being is endowed from birth with physical, intellectual, and emotional characteristics, all of which have the capacity for change. We also know that when individuals are confronted with a need for change in their food habits, especially for health reasons or during periods of privation, they react differently.

There are many blocks to the changing of food habits, some of which may represent inertia or even resistance to change. People have even been categorized as: (1) those who seek to lead groups to change, (2) those who accept change easily, and (3) those who resist change.

Certain factors that relate to the reaction to change in food patterns must be understood and considered by those who wish to make a change. The primary deterrent to this change may be fear of the loss of a familiar food which has been basic to the individual's security. Here there is a conflict of choice between the old and the new. Lack of understanding of what is needed and why also is often a block in making a change. Rebellion against authority and the insult of being deprived of personal choice likewise can be basic deterrents. Resistance to change also may be traced to treating the *effect* of a food habit such as obesity instead of recognizing, understanding, and effectively treating *underlying* or *accompanying* psychological factors.

Graubard, in his discussion of food taboos, says:

> *A taboo may become established because the animal is a totem, or because it resembles some other animal already in ill repute, or because its name may inspire some evil association, or it may symbolize an undesirable quality. Often animals become tabooed simply because they are not eaten.*

He speaks of shell fish not being eaten in places far from the source of supply. Margaret Mead, in *Cultural Pattern and Technical Change*, says that changes which concern a program aimed at control of the social processes are more effective than changes directed to individuals.

The Committee on Food Habits, in Bulletin 111, points to some basic reasons why some foods are eaten. They say:

> *Whenever food becomes a part of the celebration of a holiday, the observance of a religious feast, the mark of some life crisis such as a funeral feast, the setting for some business transaction or for the maintenance of social position, a great many reinforcing factors enter in to make certain foods valued and other disapproved or reserved for special occasions.*

It is also suggested here that resistance to a series of suggested dietary changes may be traced to fear of losing the food in its "culturally oriented significance." So even the inclusion of one favorite dish into a menu for mass feeding may weaken the resistance to change. This has been experienced often by nutritionists and dietitians in school and hospital feeding.

Burgess and Dean, in *Malnutrition and Food Habits*, point out that in self-sufficient peasant-type cultures where even a meager diet has proven adequate for survival, planting, harvesting, storage, and consumption are closely interwoven. Survival in such a situation demands transmitting the whole pattern to each succeeding generation; a single change in this pattern may bring disaster.

Margaret Mead, contrary to some other writers, warns that food habits are not always harder to change than other personal habits. She believes that the resistance to changing food habits may be related to patterns of rearing children. Thus, she postulates that where children "are fed lovingly and food is a great source of pleasure and delight" there is resistance to change. She also says that the difference in how immigrants change their food patterns is related to whether they like the foods of their native lands. It is known that immigrants first change the kind or manner of wearing clothes and their language because they do not wish to be conspicuous. But eating is a private affair with a family in one's own home and, therefore, food habits are changed last. Others have postulated that emigrants to a new country, especially if they eat out at their place of work, change their weekday meals but cling to the Sunday dinners of their native land.

Some believe that food habits are resistant to change because they are a form of self-expression, but it is hard to understand why this is more true of food than of clothing.

Many studies have shown that it is easier to change food habits in the young than in the old; therefore a delay in attempting to make a change is unwarranted.

The mere possession of knowledge does not guarantee a change, though probably too often professional people whose business it is to give out knowledge behave as if this were not true. Dr. Charlotte Young's studies have shown that nutritional knowledge is greatest in the younger, better educated homemakers from the upper-income brackets. She found, when she studied what the homemaker knows about nutrition, that the number of years of formal education, even when nutrition *per se* was not studied, was highly related to the knowledge of nutrition. Many of us agree with her that merely "studying what to eat" does change food patterns, at least in some people.

Frederick C. Fliegel, in a study of food habits and national backgrounds, also found that educational level was a potent factor in the adequacy of the diet served in the families he studied. He points out that occupation reflects income as well as status. He also believes that such factors as the Italian background of liking fruit fresh and the milk-drinking habits in their homelands also may have affected his findings.

In a study of changing food habits of rural children in Dakota County, Minnesota, it is reported that the children improved their food practices when they discovered what changes they needed to make and were "strongly motivated to learn about foods and to apply what they learned to their own diets—that is, if they had access to these foods in needed amounts." These investigators point to the fact that the best teaching is done where the teachers are well informed and highly motivated to teach the subject, and where the facts are put into practice within the environment as in the school lunchroom. Projects under the poverty program, such as Head Start, also have set up a prerequisite that concerns making food available to children to try to improve their food habits. Therefore, these programs require that parents be educated simultaneously with children.

Martha Hollinger and Lydia J. Roberts, in their 1929 study of "Overcoming Food Dislikes: A Study with Evaporated Milk," point out that favorable attitudes are contagious, that repetition itself is not enough, but that "repeated tastings together with the right mental attitude are essential to learning to like a new or disliked food." Many studies in the last nearly forty years have reinforced these ideas.

Increased income and improved standards of living bring a simultaneous change in food habits, especially in the use of the more expensive animal foods.

Perhaps the entire philosophy of community development programs around the world should be emphasized here. The first prerequisite of those programs, especially where outside food aid is given, is to find out what the people themselves want. Dr. Roberts and her co-workers say, in their reports of the Puerto Rican Dona Elena Project, that changes in nutrition must be first preceded by general changes in ways of living which follow the desires of the people. Burgess and Dean confirm that this first step may have little to do with nutrition, but it must be founded on what the people want and can take part in accomplishing. Thus, from the first, successful achievement, hope, and confidence are engendered, and horizons of needs and motives are widened.

It also has been recognized that the majority of the peoples of the world, especially those in the developing countries, now live in societies which are in a state of rapid change and where old patterns are being replaced quickly by new ones. In most of these groups there are the desires to improve the standard of living and to give the children a better chance for survival. Often, however, it must be demonstrated to these people that there is a connection between health and food. Those who work in international programs believe that the task of changing food habits in many places is one in which the nutritionist, the agriculturist, the economist, and the anthropologist must work together to change present nutritional patterns to more desirable ones.

Jean A. S. Ritchie warns that:

> *With the rapid spread of modern civilization during the present century, many peoples are in a transitional stage between old and new cultures. Too rapid an advance can create grave difficulties.*

She also says that to teach people to drink milk and eat raw salads may be disastrous when the available supply of these foods may carry organisms of dangerous diseases.

The UNESCO book on *Cultural Patterns and Technical Change* gives reasons why "the introduction of change, however limited and harmless, can be very disruptive." We quote:

> *To introduce adequate nutrition, it is most important to bring about changes that are in keeping with the established food habits of the people, and are acceptable within the framework of their value system.*

It is known that it is better to improve than to change a food habit, because every diet has its "good" as well as "bad" points. Often, increasing the use of a highly nutritious food, such as certain varieties of beans in Latin American countries, is wiser than upsetting a familiar, trusted, food pattern. Dr. Roberts, for instance, in Puerto Rico, promoted the use of calabaza, an already acceptable yellow squash.

National influences are described by Dr. E. Neige Todhunter, one of the authors of this book, in a talk which she gave at the Plenary Session of the Third International Congress of Dietetics in London in 1961. She sums up changes in the American dietary history during the last 350 years by dividing this history into three periods. The first was the colonial period (1600–1800); the second was the period of westward exploration, development, and industrialization (1800–1900). In describing the third period, that of the twentieth century, she discusses the new influences which have been brought to bear on the food pattern:

> *. . . [the] twentieth century, brought new influences to bear on the basic food pattern. The young science of nutrition grew rapidly, food values received attention and the knowledge was spread throughout the land by the schools of home economics, the experiment stations, and the extension service home agents who worked with rural families in every state. Tomatoes ceased to be regarded as a luxury and were recognized as sources of vitamin C as were citrus fruits; fruits, vegetables, and salads received new dietary emphasis. Regional food patterns, such as the fried chicken, corn bread, grits, and greens of the South; chile beans and barbecued beef and corn cakes of the Southwest; and German-type foods of Pennsylvania, which had been maintained in early isolation continued to be used and still are but they were quickly shared by others as highways and automobiles linked every hamlet of the country.*
>
> *Today is the age of technology with new means of preser-*

> *vation and packaging and endless new products, such as packaged mixes, cooked frozen meals, minute preparation foods, and fast transportation. These make all food products available the year around to everyone. More food is purchased at the supermarkets and more people eat away from home. Three meals a day is the pattern with a coffee break, mid-morning and afternoon.*
>
> *Today's food pattern retains a dominance of the early foods of the new land but these have been modified and have blended with the patterns of scores of nationalities that came as immigrants. There have been shifts in the amounts of various foods used, as nutrition science spread and all this has given rise to a more universal pattern accepted because of advertising and the mass media and because of the remnants of the pioneer spirit which leaves people still willing to try something new, especially in food and recipes.*
>
> *The country that has been called the melting pot of all nationalities also has become the melting pot of all nations' food patterns.*
>
> *Over the last fifty years there has been little change in the consumption of meat, fish and poultry; an increase in the use of dairy products especially over the last twenty years; slight increase in fats and oils; increase in sugars and syrups; a steady decrease in grains and potatoes; and a marked increase in the use of citrus and tomatoes and also in green and yellow vegetables.*

This describes a national pattern made by many individuals and forming the background for the individual food patterns of millions of Americans. Perhaps this, best of all, illustrates what Margaret Mead and Jean Ritchie mean—that to change fundamental food habits, a whole culture must change.

We have numerous other proofs of the changes of food habits from countries all over the world and throughout all history. It is said that man probably gave up the use of acorns as one of his staple foods after a devastating blight of oak trees when he found other foods he preferred. Wheat bread is said to have been invented in Egypt when the use of barley declined. Oats have been either stoutly defended or rejected as food, and the idea of rejection probably spread from predynastic Mesopotamia into Greece and Rome. It is said that the Scythians scorned the Gauls for using a cattle feed for human food, as did the English later ~~so~~ scorn the Scots.

Four steps have been shown to be desirable in a deliberate attempt to bring about a change.

1. Those who possess the knowledge must want to bring about a change.
2. The group whose practices need changing must be helped to know that they need to change.
3. This group must be motivated to make the change.
4. It must be possible for the group to make the change; in other words, in the case of changing food habits, the food must be available.

STUDY QUESTIONS

1. Can you explain how food patterns are culturally oriented?
2. What differences in your own food patterns have come from your own family background?
3. How can the Maslow theory be used to explain food practices?
4. Why is a study of festival foods important in understanding the culture of a group?
5. On page 112 Poppy Cannon is quoted. Can you justify her statement with illustrations from the literature?

TOPICS FOR INDIVIDUAL INVESTIGATION

1. Describe in detail the food habits of one ethnic group of people, pointing out similarities as well as differences from the food habits and foodways with which you are most familiar. Give the background or reasons for the difference wherever you can.

2. Study the food habits of five families in detail. Point out how each has its own individual characteristics.

3. Describe a program where making a food or several foods available caused a real change in food habits.

4. Trace the changes in consumption of five foods in the United States during the first six decades of the twentieth century. Gave basic reasons for these changes.

5. Show how a group of people such as the Amish or those of the Amana Colony in Iowa influence the foods of their neighbors. Also show how these distinct patterns of ethnic groups settled in a defined area are influenced by their neighbors.

6. Use any popular American cookbook to try to discover foods introduced by some immigrants.

7. Discuss the American breakfast patterns in relation to various sections of the country.

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5

FOOD, MAN, AND RELIGION

The various religions of the world have a profound influence on man's dietary practices and customs. Over the centuries of man's recorded and unrecorded history, many religions have decreed what foods man could or could not eat, what foods he could or could not eat on certain days of the year, and frequently how certain foods must be prepared for consumption. Many of these dietary habits have become symbolic of the religion itself.

What are some of these religious influences on diet? What are the religious bases for these dietary practices? How did they develop? What is the significance today of these influences? These are a few of the many questions that seem important to examine when developing a deeper understanding of the relationship between food and man.

It has been said that religious beliefs and practices are perhaps the least understood aspects of the cultures of other peoples. On casual examination the various religions of the world appear widely different. Each has its own beliefs concerning the supernatural, its own sacred objects, its own symbolism, its own priests, ministers, or holy men, its own seemingly mystical rituals and prescribed activities, and its own moral values. However, if a more detailed study of the world's religions is undertaken, many of these apparent differences dissolve and a large number of similarities appear.

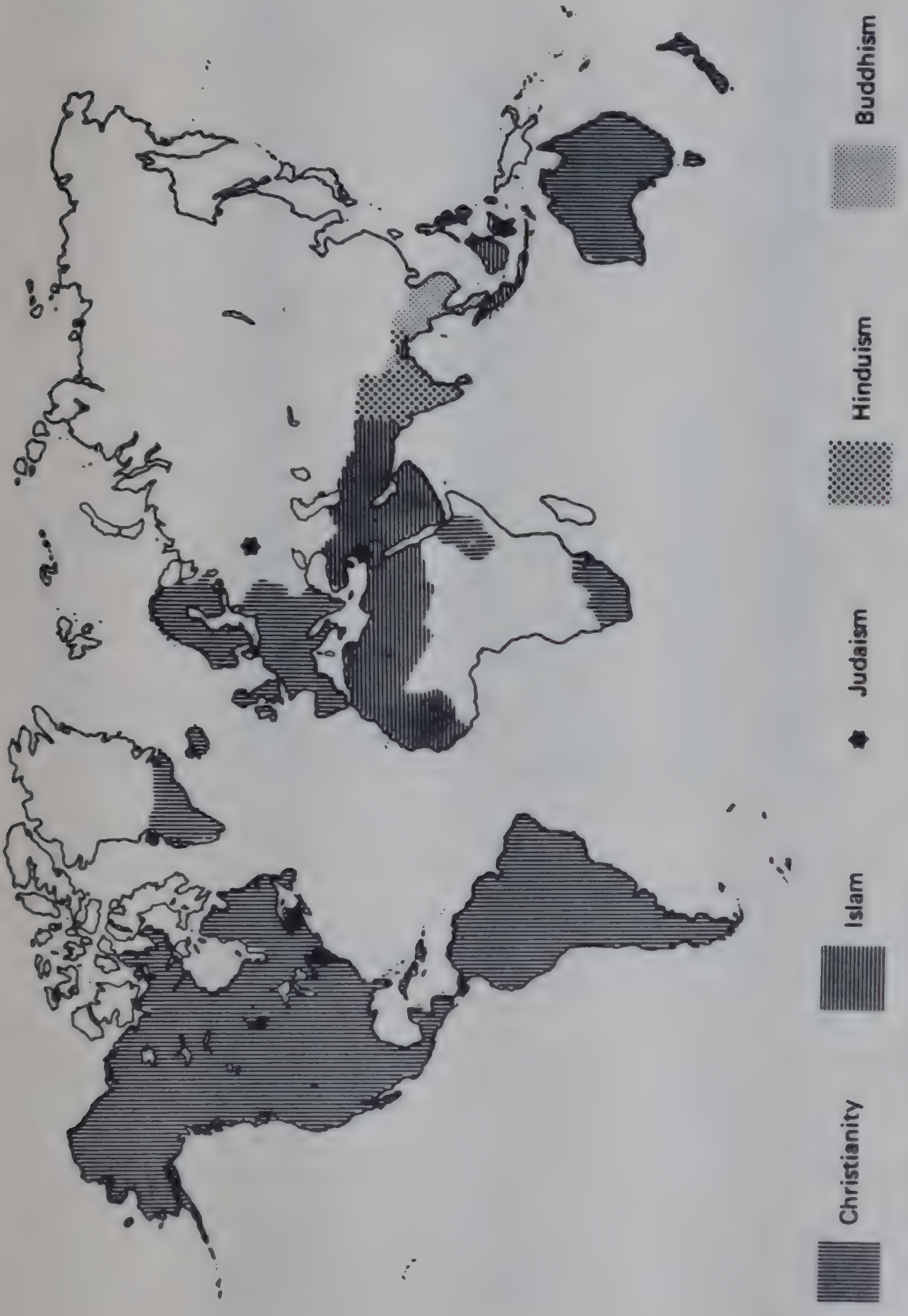
What is meant by the term religion? It undoubtedly has different meanings to many people. No attempt is made in this section to discuss all the intricacies of this subject. According to Webster's dictionary, religion is the service and adoration of a god through worship in obedience to divine commands found in the sacred writings and through the following of a way of life regarded as incumbent on true believers. It further states that religion is a conviction of the existence of a supreme being or some supernatural influence which controls the destiny of all.

Brown, in *Understanding Other Cultures,* states that every religion provides ways by which man can try to relate to a supreme being or some supernatural force. Many of the practices and beliefs of the various religions of man are attempts to explain those things which man himself cannot understand or control. Each religion has evolved certain rituals or customs which are important to the members of that religion. The observance of these rituals and customs is believed to be mandatory since they express and reaffirm the various beliefs of the religion.

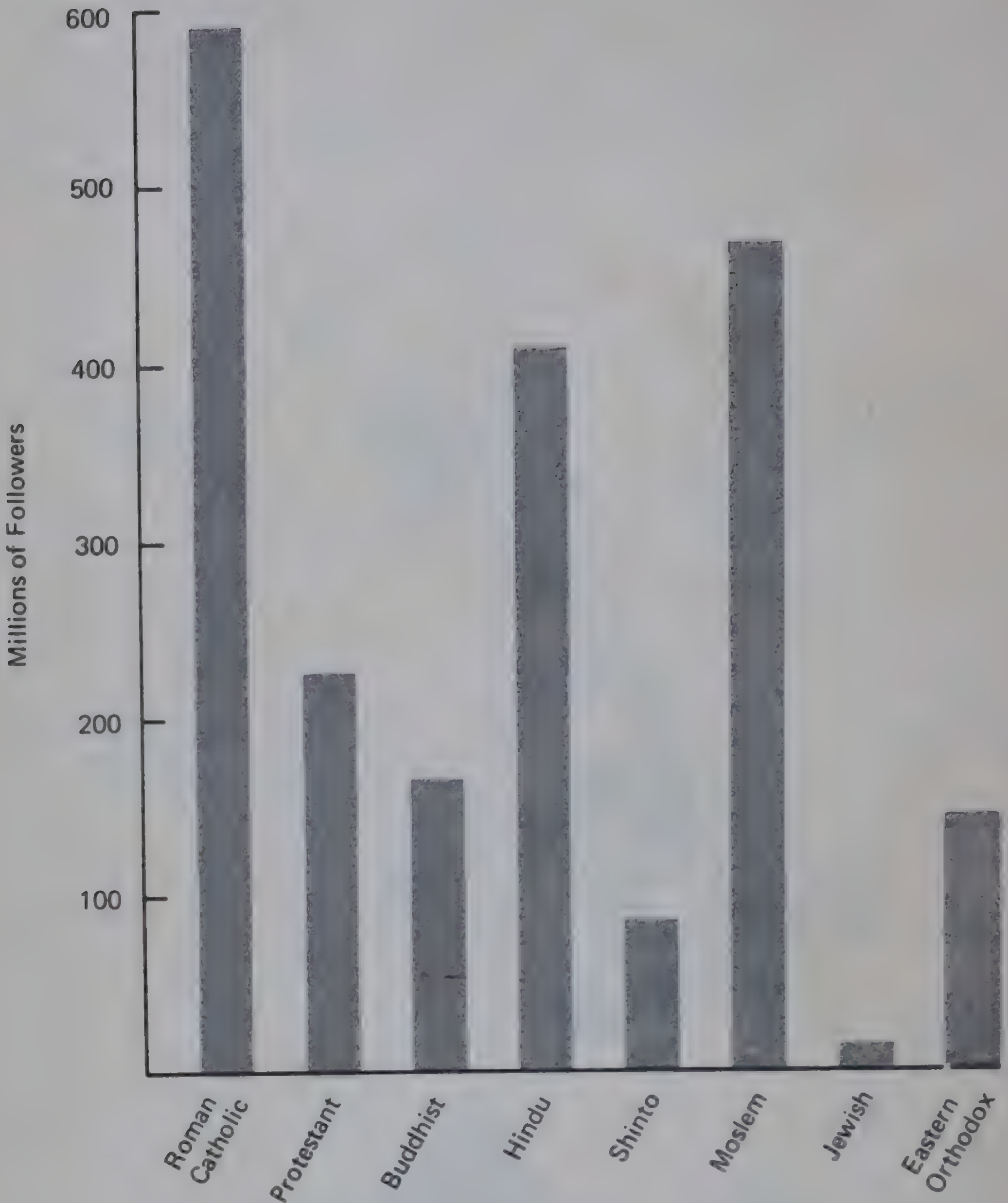
Food, which was early man's most precious and often scarce possession, has become associated with many of these religious rituals or customs. The practice of giving food or abstaining from food has provided man in his everyday life with a symbolic way to indicate his devotion, respect, and love to his supreme being or supernatural power. Furthermore, the act of giving or abstaining from food has been used to insure the good will and protection of the all powerful on behalf of the individual. The religious practices of most religions are deeply imbued with many symbolic meanings; without an understanding of this symbolism, the practices of the religion by themselves may seem strange and peculiar. Brown gives an example of this. To a Protestant, the symbolic meaning of the bread and wine in the Communion Service is clear. But to someone totally unfamiliar with this symbolism the words, "This is my body broken for you . . . This is my blood . . .," which are recited before the bread and wine are consumed, might indeed seem very peculiar.

FIVE MAJOR RELIGIONS

In this chapter, five major religions of the world and the relationship between these religions, food, and man will be discussed. These religions are Christianity, Judaism, Islam, Hinduism, and Buddhism. The areas of the world where these religions predominate are shown on the map. Relationships between food and other religions such as Shintoism, Confucianism, and various tribal religions undoubtedly exist and would be interesting topics to pursue. However, based on available figures (1966), these five major religions together were estimated to



Distribution of five major religions in the world. (Adapted from: Joseph Gaer, *How the Great Religions Began*, Dodd-Mead, 1956.)



Number of followers of world religions, 1966.

encompass about sixty percent of the world's population; the above graph, for this reason, was selected as the basis for this discussion.

Christianity

Christianity is the most widely spread of all the major religions in the world today. Its adherents numbered in 1965 some 961 million—approximately one out of every four people in the world. Of these 961 million Christians, sixty-one percent were Roman Catholic, twenty-four percent were Protestant, and fifteen percent were Eastern Orthodox.

It is not possible in this book to discuss in detail the influence of all the Christian religions on the food habits of their adherents. Almost everyone is familiar with the ruling of the Roman Catholic Church which until recently required Catholics to observe certain fast days and to abstain from eating meat on Fridays in remembrance of the sacrificial death of Christ. However, in 1966, the United States Catholic Conference abolished this church law; now Catholics are required to abstain from eating meat only on the Fridays of Lent.

Among some Protestant denominations, such as the Seventh-Day Adventists and the Church of Jesus Christ of the Latter-Day Saints, certain dietary practices exist which are an integral part of their religious beliefs. However, to the average westerner, the Eastern Orthodox Church is probably the least familiar branch of Christianity and thus merits a closer look. Historically, Orthodox Christian Churches were established in the Holy Lands before Christianity spread to Rome. But by 300 A.D. the two principal centers of Christianity were Rome and Constantinople, and they had already begun to compete with each other for absolute power and authority over all Christians. In 1045 A.D. this power struggle finally culminated in a division of the followers of Christianity into the Church of Rome and the Eastern Orthodox Church. Some main points of disagreement between the two groups were the origin of the Holy Ghost, the use of unleavened bread in the Communion Service, and clerical celibacy. The Eastern Orthodox Church believed that the Holy Ghost originated completely from God the Father, that leavened bread should be used in the Communion Service, and that priests should be allowed to marry. The followers of the early Eastern Orthodox Church were the Christians of the Middle East, the Balkans, the northeastern Mediterranean area, and Russia. Eastern Orthodoxy is the state religion in many of these same countries today. All of the state churches are independent of each other and have their own separate patriarch or archbishop. But they acknowledge as their spiritual leader the patriarch of Istanbul. The world membership in 1965 was 143 million with 3 million adherents residing in the United States.

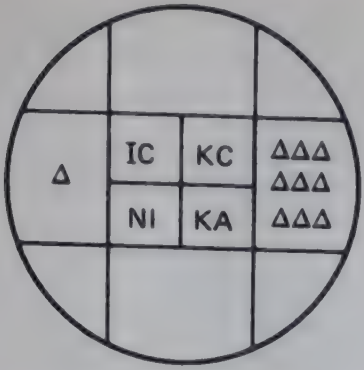
In the Greek Orthodox religion, numerous fast days provide ample opportunity for man to prove that he does not live by bread alone but that the soul can rule the body. With only two exceptions, every Wednesday and Friday of the year are considered fast days to commemorate the betrayal of Christ and His death upon the cross. In addition, there is a forty-day fast called the Great Lent which precedes

Easter and there is another forty-day fast called Advent which begins on November 15. Two shorter fast periods in June and August also are observed.

On these fast days no meat or animal products including milk, butter, and cheese can be eaten; fish, with the exception of shell fish such as clams, shrimp, and oysters, also cannot be eaten. Abstinence from olive oil, not olives, is observed by the more devout older Greeks. The exact reason for this latter practice is not known, but one possible explanation is that many years ago olive oil commonly was stored in casks lined with the stomach of the calf; thus the olive oil was contaminated in a religious sense by having been in contact with an animal product. Moreover, in earlier times olive oil was thought to increase sexual desire. Since every fast day is supposed to be a day of sexual abstinence, this may be another explanation of the avoidance of olive oil. A popular common meal in Greece on fast days is dried bean and lentil soup.

Easter, the most important event in the calendar of the Orthodox Church, occurs on the first Sunday after the full moon which occurs on or immediately after March 21, but it may not precede the Jewish Passover. Thus, in some years Easter is postponed to the first Sunday after the Jewish Passover. Every four years the dates of Easter in the Orthodox Church and the Roman Catholic Church coincide. The forty-day Great Lent period is preceded by a three week prelenten period of preparation and repentance. The third Sunday of this prelenten period is called Meat Fare Sunday (Apokreos). All meat in the house is consumed or disposed of on this Sunday and during the week following. On the following Sunday, Cheese Fare Sunday, all cheese, eggs, and butter in the house are consumed. On the next day, "Clean Monday," the family is ready to begin the true Great Lent and abstain from all animal foods until Easter Sunday. Fish is allowed on two days during this fast—on Palm Sunday and the Annunciation Day of the Virgin Mary. The Great Lent fast is in memory of the Lord's forty-day fast in the desert and of Holy Week. Lentil soup is always eaten on Good Friday to symbolize the tears of the Virgin Mary. The lentil soup often is served with vinegar to recall that Christ on the cross was given vinegar instead of the water He requested.

The Greek Easter fast traditionally is broken after the midnight Resurrection Service on Easter Sunday with mageritsa, a soup made with the internal organs of the lamb such as the tripe, liver, pancreas, lungs, and heart. Lamb is the traditional food on Easter. Another traditional Greek custom is the baking of thick, round, leavened loaves of Easter bread decorated with colored, hard-boiled eggs. The eggs are al-



The Prosphoron seal marks the altar bread.

ways dyed bright red, symbolic of the blood of Christ which redeemed the world. The eggs are dyed only on Holy Thursday and Saturday and are considered tokens of good luck in the home. The eggs are placed on the top of the bread dough and then the bread is baked. The breaking open of these eggs on Easter morning symbolizes the opening of the tomb of Christ and is an outward sign of belief in the resurrection of Christ. One person says, "Christos Anesti" (Christ is risen), the other person replies "Alithos Anesti" (Indeed, He is risen), and each cracks his egg against the other's egg.

All members of the Greek Orthodox Church are encouraged to receive Holy Communion every Sunday at the celebration of the Divine Liturgy. The altar bread used for this service is called Prosphoron, meaning the bread of offering. These round loaves of leavened bread are usually prepared by the women in their own homes from the purest ingredients. The bread must be free of all shortening, milk, sugar, and eggs. The preparation of Prosphoron serves to actively involve the laywomen of the church in an all-important religious rite, because it is believed that the priest in the Divine Liturgy service has been given the power by Christ actually to change the bread into the body of Christ and the wine into His blood. As the dough of the Prosphoron rises for the second time, a Prosphoron seal is placed on top of the dough and left there until the bread is ready to bake. The Prosphoron seal marks the bread as indicated in the drawing. The center portion of the loaf represents a lamb and is the part of the loaf which becomes the body of Christ. The abbreviations IC and KC indicate Jesus Christ and the letters NIKA mean conquers. The priest at the Communion Service removes this section of the Prosphoron and places it on a platen along with the ten smaller triangular pieces. The small triangular piece on the left of the center portion is in memory of the Virgin Mary; the nine pieces on the right are in commemoration of the Angelic Hosts and

Saints of the Orthodox Church. The Prosphoron offering is brought to the altar before the service with two lists of names. One list is composed of the names of living friends or family members and the other list of dead ones. During the service the people namd in the lists are remembered; good health is wished for the living and pleasant repose for the dead.

Boiled whole grain wheat (Koliva) plays an important role in memorial services for the dead. It is customary in the Greek Orthodox Church to offer Koliva before the altar three, nine, and forty days, as well as six and twelve months, after the death of a family member. It also may be offered whenever desired thereafter. The Koliva symbolizes the resurrection of Christ. The offering of Koliva on the third, ninth, and fortieth day after death is related to the recorded appearances of Christ on earth after his crucifixion. The boiled wheat, symbolizing everlasting life, is mixed with parsley, chopper walnuts, zwiebach biscuits, spices, sugar, raisins, blanched almonds, sesame seeds, and pomegranate seeds. The raisins and the pomegranate seeds are used as symbols of sweetness and plenty. A leveled mound of the mixture is placed on a silver tray and sprinkled heavily with powdered sugar. The sugar covering symbolizes the wish of the living that the departed will have a sweet and blissful life in heaven. In the center of the Koliva a cross is made with brown sugar or Jordan almonds. Beneath the cross, either the name or the initials of the deceased is placed by using either toasted almonds, brown sugar, or raisins. The Koliva is blessed by the priest at the morning service and is later distributed to friends of the deceased.

Judaism

The ancestors of the Hebrews, who can be traced back to about 2000 B.C., were seminomads roving the lands of Egypt, Syria, and Mesopotamia. The beginnings of Judaism, God's covenants with Abraham and later with Moses, are recorded in the first five books of the Old Testament. As God's chosen people the Jews were commanded to denounce idolatry and polytheism, to worship only the one true God, and to ascertain and obey His will in all matters. The Torah, composed of the books of Genesis, Exodus, Leviticus, Numbers, and Deuteronomy, is the most sacred writing of Judaism and contains the basic laws which express the will of God to the Jew. The Torah, meaning guidance and direction, is considered by the Orthodox Jew to be the ultimate authority regarding all human conduct. This guiding principle of Judaism is read aloud at every Sabbath service in the synagogue; the entire five books are read in a year.

Other sacred books, such as the Talmud, were written at later times. Over the centuries the early rabbis attempted to interpret, amplify, and adapt the teachings in the Torah to make them more meaningful to man in his daily life. These interpretations of the Torah became known as the body of oral law and were passed down from generation to generation by word of mouth. Sometime in the latter part of the sixth century A.D., the body of oral law finally was committed to paper and became known as the Talmud. The teachings from the Torah and the Talmud range all the way from the Ten Commandments and the Golden Rule to detailed instruction regarding the proper attire to wear on the Sabbath.

Throughout most of their history, the Jewish people suffered persecution, isolation, enslavement, and, on several occasions, near extermination. Yet each time they survived and were delivered from their oppressors. To the Jew each of these expriences represents a reenactment of the deliverance of the Jewish people from bondage in Egypt centuries ago and serves to strengthen his belief that the Jewish people truly are the chosen people of God.

As the chosen people the Jews have certain responsibilities to God. Judaism teaches that man is capable of perfection and that he alone is responsible for his actions. Man has a choice between what is right and wrong. Sin is attributed to man's innate weakness; no man can completely escape it. Although Judaism recognizes the existence of a hereafter, its main concerns are with man in his present life and the ways to guide him in fulfilling his moral responsibilities to God.

For the Jew the Torah makes a distinction between those animals which are considered clean and are thus permitted to be eaten and those considered unclean and thus forbidden. Leviticus, Chapter 11, and Deuteronomy, Chapter 14, give the Biblical basis for many Jewish dietary practices. Animals classified as clean are those that chew their cud and whose hooves are divided (cloven). If an animal satisfies only one of these criteria, he cannot be considered clean. Thus the cow, sheep, ox, and goat are clean but not the pig since he does not chew the cud. Although the camel chews his cud, he is unclean because he does not have cloven hooves. Also forbidden are most winged insects, reptiles, creeping animals such as the mouse, and birds of prey. Only fish with both fins and scales are permitted to be used for food. Thus all shell fish and eels are eliminated from the diet of an Orthodox Jew. Any meat from animals which have died either from natural causes or disease is considered unfit.

Blood is a sacred substance and is taboo for human consumption. Several references in Leviticus, Chapter 17, which give the basis for this dietary practice, are, "I will set My face against that soul that eateth blood" and "For the life of the flesh is in the blood." To the ancient Jews, killing was synonymous with the shedding of blood; the blood was thus considered the vital life of the animal.

The internal fat of an animal is also taboo. Thus only those soaps and scouring powders which do not contain animal fats may be used for washing dishes. Detergents are permitted.

Another Jewish dietary practice which can be related to Biblical teaching is that which prohibits eating meat and dairy foods together in the same meal. The exact reason for this practice is not clear, but it may be the result of the three statements in Exodus and Deuteronomy which warn not "to seethe a kid in its mother's milk." Not only can meat and milk not be eaten at the same meal, meat cannot be prepared or served in the same dishes used for preparing and serving foods containing milk and other dairy products. Thus, in Orthodox Jewish homes, two sets of dishes, silverware, and cooking utensils are needed, one for use with meats and the other for use with foods containing milk and other dairy products. Each set of dishes and utensils must be washed separately and carefully handled so that one set does not become mixed with the other. An Orthodox Jew will wait six hours after eating meat before eating milk or any dairy food, but only a one-hour interval is necessary if milk is consumed prior to meat. This dietary regulation prevents anyone who has meat in a meal from having such things as cream in his coffee, dessert containing milk, or even butter on his vegetables.

The attempts of the early rabbis to interpret and expand the Torah in more specific terms, as mentioned earlier, resulted in the Laws of Kashrut as written down in the Talmud. The term kasher (kosher) refers not only to those foods which are permitted by the Bible but also to foods which have been processed and prepared in the prescribed manner. Trayf is the term used to indicate either a food that is unclean according to the Bible or one which has not been prepared according to the ritually correct method.

A rabbi must supervise the slaughtering of all animals in order for them to be considered kasher. In fact, only one other ritual in the Jewish religion actually requires the participation of a rabbi, and that is divorce. The actual slaughter of the animal is done by a trained person called a shocket. One swift deep slash at the throat of the animal makes him unconscious immediately and allows the blood to drain from his body as completely as possible. The meat from animals so slaughtered is carefully inspected and then stamped with the seal of the shocket to indicate its ritual purity.

Meat to be truly kashrut must also be treated further to ensure the complete removal of blood. Meat is soaked in cold water for thirty minutes and then allowed to drain on a slanting board. The meat is then generously sprinkled with salt. After one hour it is washed in cold water; then it is ready to be cooked. In the past this task was usually performed in the home but it is now possible to purchase meat which has been treated in this fashion.

Although no Biblical reference can be found to justify the practice, the Jew is forbidden in the Talmud to eat the sciatic nerve of an animal. According to Epstein, kosher butcher stores in the United States sell only forequarters of meat; the ligaments and nerves of the hindquarters are very difficult to remove and must be removed if the meat is to be considered kasher.

From the earliest times rabbis have devoted considerable time to determining what was acceptable as kashrut and what not. The increasing number of processed foods appearing on the market in recent years has made this problem perhaps even more difficult for the Jewish housewife. The problem has been alleviated somewhat by the use of certain symbols on the labels of processed foods. The commonly used symbols are U or K which refer to the Union of Orthodox Jewish Congregations and the O. K. Laboratories, respectively. The presence of these symbols on a label indicates that the food is kasher and that it has been processed following the Laws of Kashrut. The introduction of such products as margarine and nondairy cream substitutes has made it possible for the Jew to circumvent the dietary restriction regarding the use of meat and dairy products in the same meal. A nonanimal "gelatin" was put on the market which enables the Orthodox Jew to have congealed salads and desserts.

The Jewish holy days and festivals are rich in symbolical meanings, and food plays a major role in much of this symbolism. Every Sabbath is truly a day of rest and spiritual reunion in an Orthodox Jewish home. In most homes, Friday is spent preparing for the Sabbath which begins at sundown and continues until sundown on Saturday. The Sabbath dinner on Friday evening is prepared with great care. All food that will be eaten on the Sabbath is prepared and cooked ahead in accordance with the belief that the Sabbath should be a day of rest. The traditional items on every Sabbath table are two loaves of bread called challah. The custom of serving challah on the Sabbath goes back many centuries to the ancient practice of placing twelve challah loaves on the altar of the Temple in Jerusalem; each loaf represented one of the original tribes of Israel. The use of two challah loaves today is in remembrance of the double portion of manna which God provided the Israelites on Friday for the Sabbath during the forty years they spent wandering in the wilderness.

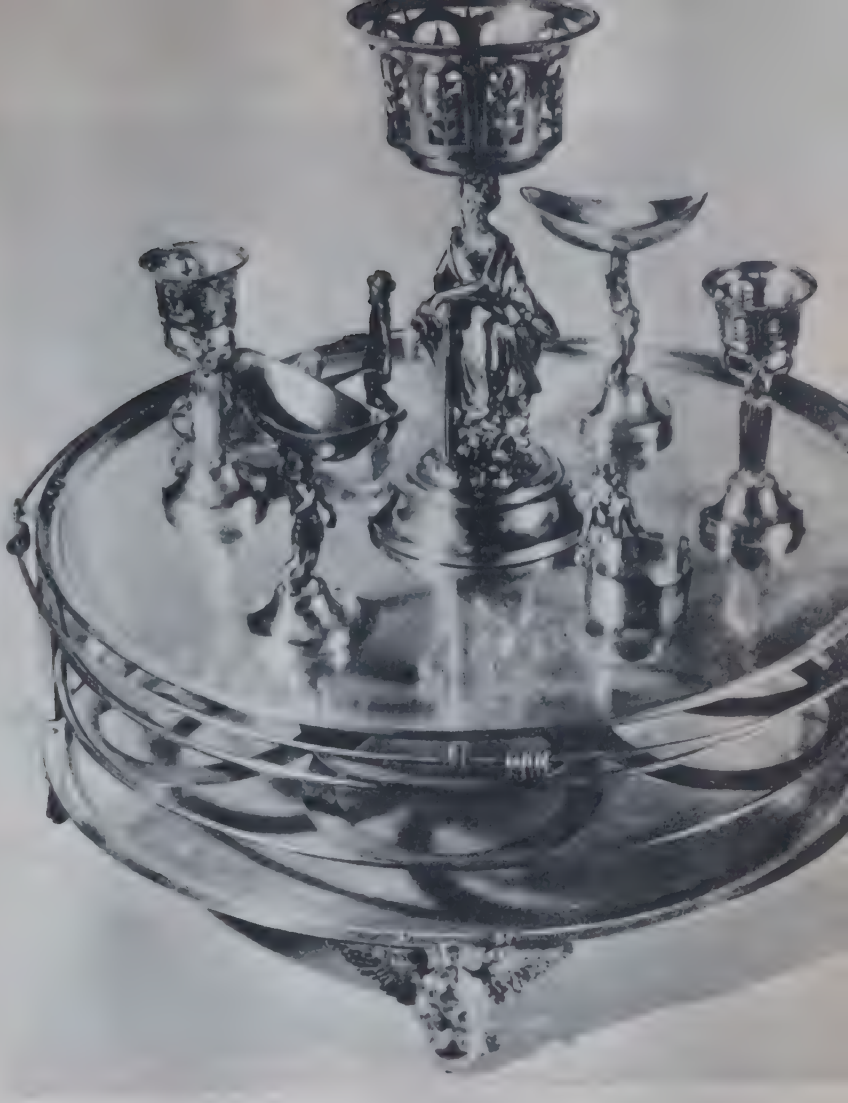
The ten most solemn holy days of the Jewish year begin with Rosh Hashanah, the Day of Judgment, and end with Yom Kippur, the Day of Atonement. On Rosh Hashanah, the challah is also made but it is decorated with ladders or birds baked on the top to carry symbolically the prayers of the family to heaven. Bread and slices of apple are dipped in honey as a symbolic wish for sweetness in the new year. Yom Kippur is a day of complete fasting for all except children under thirteen years of age.

The symbolic role of food in the Jewish faith is perhaps most evident in the traditional practices observed during the eight-day Festival of Pesach (Passover) which commemorates the flight of the Israelites from Egypt as described in Exodus. The story of the liberation of the Jews is relived by all members of the family, especially at the seder meal which is eaten on the first evening of this festival. The preparations in an Orthodox Jewish home for Passover are many. According to ritual laws, none of the foods used everyday in the kitchen can be used during Passover. Especially prepared foods marked Kasher L'Pesach (Kosher for Passover) must be used.

No leavened bread can be eaten during this time in obedience to God's command to Moses. For centuries the Jews have made an unleavened wheat bread called matzo. It was made especially for Pesach and prepared ahead of time in large enough amounts to last throughout the entire eight-day festival. This preparation was usually a project of the whole community; detailed instructions for its preparation are given in the Talmud. Today matzo is commonly prepared commercially under rabbinical supervision. It is possible even to obtain a special kind of matzo which has been prepared under the most exacting, ritually correct conditions, the wheat having been constantly watched during harvesting, milling, and baking. This latter type of matzo is used by some of the more pious, older, Orthodox Jews.

Flour and other grains cannot be used in cooking during Passover. In place of flour the Jewish housewife uses finely ground matzo called matza meal. No leavening agents nor malt liquors may be used during Passover. In fact, it is a custom for an Orthodox Jew prior to Passover to write out a bill of sale and sell all the leavened products he owns to a non-Jew for the duration of the Passover. The sale is proposed with the understanding that the goods will be returned to the original owner after the holiday. The rabbi handles the transaction for the members of his congregation at their request. All leavened products in the home are either eaten or discarded prior to the beginning of Passover.

Passover seder plate made in Vienna, Austria, in 1815. It has various containers for the traditional foods associated with Passover. (Courtesy of Hebrew Union College Museum, Cincinnati, Ohio)



Many Jewish homes have separate sets of dishes that are used only during the Passover. If everyday utensils have to be used during Passover, there is a prescribed ritual for purifying them.

The seder plate is usually used twice a year, on the first and second nights of Passover. The beautiful, silver, Viennese seder plate shown in the picture dates back to 1815. It has various containers for the traditional foods that, over the centuries, have become symbolic of the Jewish exodus from slavery in Egypt. In the boatlike containers would be placed a roasted egg and a roasted lamb bone. The roasted egg is generally considered to be a symbol of the burnt offerings made in the Temple at Jerusalem; the lamb bone symbolizes the Paschal lamb which in ancient times was sacrificed at the Temple. The containers carried by the two women would be filled with maror and karpas, respectively. The maror (bitter herb such as horseradish) recalls the bitterness of slavery; the karpas (usually parsley or celery) represents the

A Jewish Passover seder meal when matzo instead of bread is eaten. (Courtesy of The B. Manischewitz Co., Newark, N.J.)

poor quality of diet the Israelites were fed during their years of slavery. During the seder meal the karpas would be dipped into the container of salt water held by the hatted man and then eaten in remembrance of the tears shed by Jews while in bondage. The wheelbarrow pushed by the other hatted figure would contain charoset which is a combination of finely chopped apple, nuts, cinnamon, and wine. The consistency of the charoset is likened to that of the mortar which the Israelites used in constructing buildings for the Egyptians. On top of the commanding figure of Moses in the center of the seder plate would be placed a wine cup called the cup of Elijah. According to tradition the prophet Elijah would announce the coming of the Messiah on the seder night. Under the top of the seder plate are three shelves; on each shelf a piece of matzo, the bread of affliction, would be placed to represent the three divisions of Israel—priests, Levites, and laymen. The picture shows a father and his children celebrating Pesach and singing songs written in the Haggadah which contains the history and ritual of the Pesach festival. The seder plate is much simpler than the one from the last century, but all the symbolic foods are present.

The world Jewish population in 1965 numbered only about thirteen million, making it the smallest of the major religions in terms of numbers. Within the last century the Jews gradually emerged from the ghettos of Europe and emigrated to the United States in large numbers. Slightly over 5.6 million Jews now live within the boundaries of the United States, mainly in the northeast.

As the Jew became more a part of the outside world, it became increasingly difficult for him to carry out many of the numerous ancient customs of his religion. The end result of this conflict between modern everyday life in Western Europe and United States and the necessity of following the rigid rules of Orthodox Judaism was the division of the Jews into three groups: Orthodox, Conservative, and Reform. All three groups are agreed on most matters of basic theology but differ in their interpretations of the ancient rituals and the value received from observing these rituals in today's world. The Reform Jew conforms least to the old customs and rituals such as those described. He does not practice the various dietary restrictions or obey the Laws of Kashrut. In addition, various changes have occurred in the Reform Sabbath service. The Reform Jew rejects the use of prayer shawls and skull caps. The Torah is read in English as well as Hebrew. Organ and choir music are allowed, and men and women are allowed to sit together in the Reform Temple. The Conservative Jew is a blend of Orthodox and Reform Judaism. He still observes and practices some of the ancient rituals, including the eating of only kosher foods. But he has forsaken many of the other practices of the Orthodox Jew. Accurate figures on synagogue membership in the United States are difficult to obtain. It has been estimated that each of the three branches of Judaism has about a million members. However, many Orthodox congregations are not affiliated with any national organization; thus the number of Orthodox Jews may actually be higher than the number of Reform or Conservative Jews.

To the Orthodox Jew, the ancient practices and customs that regulate his diet are intended to test his piety and love of God. To him they are part and parcel of the Jewish way of life and are some of many acts that God has directed his chosen people to perform. Until the last one hundred years or so, these dietary practices unquestionably made it extremely difficult for the Orthodox Jew to have social and cultural relations with non-Jews. The Jews were prohibited in the Talmud from eating bread baked by a Gentile or even buying from him such items as milk and wine. The Laws of Kashrut, however, gave to the Jewish people a common bond which was visible to all and served to indentify them as a particular group. This common bond no doubt has helped to unify and unite them in years past. To the Reform Jew the Laws of Kashrut are outdated and archaic and a reflection of totemism. He believes that the customs which reflect the principles of the religion should change with the times. However, Reform Jews have not introduced any new customs to reflect these principles.

Islam

Islam, the youngest major religion in the world, is both a religion and a way of life for over 465 million people. It is the second largest religion in terms of numbers of adherents. Islam is perhaps almost as widely spread throughout the world as Christianity. It is the major religion of Saudi Arabia, its birthplace, and the surrounding Arab countries of Iraq, Jordan, Syria, Turkey, and Iran. In the course of some thirteen hundred years since its founding, Islam has spread south to the African continent. Today it embraces the majority of the Egyptians, Algerians, Moroccans, Libyans, and many other people south of the Sahara such as Nigerians and Ethiopians. The teachings of Islam moved eastward to Asia; today it is the major religion in Pakistan, Indonesia, and Malaya. The only European countries which today have a sizable number of Moslems are the Balkan States and Russia.

Mohammed, the founder of Islam, was born in Mecca, Saudi Arabia, in 751 A.D. During Mohammed's early years, he came in close contact with both Jews and Christians and was impressed with their belief in one god as contrasted with the many gods of the Arabs. Although a successful trader and merchant, Mohammed was prone to spend many days and weeks in solitude in the hills surrounding Mecca. One night while Mohammed was meditating on the nature of life and the destiny of man, God spoke to Mohammed through the Archangel Gabriel. Mohammed, convinced he was mad, attempted to kill himself but was stopped by a voice saying, "Thou art a prophet." The initial doubts of Mohammed were alleviated by later visitations of the Archangel; Mohammed became convinced that he was truly a prophet of Allah, the one true God.

At first the teachings of Mohammed extended only to his family and friends, but gradually he began to voice his teachings in the marketplace of Mecca. At that time Mecca was the crossroad of two great caravan routes, the spice route from Southern Arabia to Syria and the route from Persia to the Nile Valley. It was also to Mecca that many Arab pilgrims came to worship at the numerous shrines. These visiting pilgrims and the caravan traders helped in time to spread the teachings of Mohammed to the outlying areas. However, the merchants and wealthy men of Mecca, afraid that Mohammed's teachings of submission to one god would curtail the number of pilgrims who came to the city, ridiculed and ostracized him. In 622 A.D. Mohammed fled from Mecca with some of his loyal converts to Medina. It is from this date that the Islamic calendar begins. Mohammed united the tribes of Medina and became their spiritual as well as political leader. After a few military battles, he conquered Mecca. On his triumphant return, he destroyed all the idols and declared the shrine of Mecca to be a place holy to the one true God.

Mohammed taught that there was only one God, Allah, and that all men must submit completely to His will. The word Islam means submission, and the word Moslem refers to one who submits. The God of Judaism, of Christianity, and of Islam are all basically similar because the Arabs trace their origin back to the early Hebrews through Abraham's son Ishmael. Neither Christ nor Mohammed are considered divine by the Moslem—only spokesmen of God. Mohammed is, however, the greatest since he was the latest and the last of the great prophets of God.

The followers of Islam acknowledge the divinity of the Old and New Testaments but believe that the Bible is not the final expression of the will of God. The most sacred writing of Islam is the Koran. This sacred book, although probably not written during the lifetime of Mohammed, is believed to contain the words spoken to Mohammed by Allah. It is thereby the most authoritative and final expression of the will of God; it supercedes the earlier Biblical writings. The Koran consists of one hundred and fourteen suras or chapters which all (except one) begin with the sentence "In the name of Allah, the Beneficent, the Merciful." Parts of the Koran are read daily in all Moslem schools and mosques. One of the longest suras is the second one entitled "The Cow" or the little Koran. It contains the main points of all the revelations made to Mohammed as well as instructions regarding the dietary regulations, the need for fasting, pilgrimages, and correct morals.

In the years following the writing of the Koran, scholars and other religious-minded men attempted to analyze and interpret the Koran and relate it in a more meaningful way to the daily life of the faithful followers. A growing list of traditions developed over the years based on what Mohammed either said or did or was reported to have done. These traditions became the patterns or guidelines for every Moslem to follow in almost every conceivable facet of life; a situation analogous to the Jewish Talmud.

The religious practices of those who profess to Islam are often referred to as the Five Pillars of Islam. The first of these is faith. All Moslems repeat once a day the creed "I bear witness that there is no God but Allah and that Mohammed is the Prophet of Allah." Allah is considered to be in complete control of everything. He has determined the fate of every man; whatever happens is the will of Allah. On the day of final resurrection all men will be judged worthy of either heaven or hell.

Prayer is the second pillar. All Moslems are taught to pray five times a day; at dawn, noon, midafternoon, sunset, and nightfall. The call to prayer can be heard at these times in any Moslem city. A crier climbs to the balcony at the top of the minaret of the mosque and calls out the words used by Mohammed, enjoining the faithful to prayer. Regardless of where a Moslem is, he is supposed to offer prayer. If he is not able to go to a mosque, he spreads down his prayer rug, thereby making that spot sacred, turns his face toward Mecca, and prays. Friday is the day of public prayer, and sermons are delivered in the mosques after the noon prayer.

Alms giving is the third pillar. Several passages in the Koran describe the benefits to be reaped by the giving of money to the poor, orphaned, and aged.

Fasting is the fourth pillar. The Koran promises rewards beyond bounds for fasting for God's sake. The Koran commands all faithful Moslems to observe the Fast of Ramadan; Ramadan is the ninth month of the lunar Moslem year. Since Mohammed received his first revelation on the twenty-seventh day of this month, he declared in the Koran that the entire month should be one of complete fasting from sunrise to sunset. The fast includes abstinence from water and smoking as well as food. During Ramadan, it is believed that "the gates of Heaven are open, the gates of Hell closed, and the devil put in chains." The faithful observance of the Ramadan fast is believed to result in the remission of sin. In many of the larger cities in the Arab world a cannon is fired several hours before sunrise to warn the people that the hour to begin fasting is approaching. The cannon is fired again at sunset to announce the end of the day's fast. The meals eaten after sunset are suppose to be light. A special type of leavened bread is eaten during this month. The observance of the Ramadan fast is perhaps the most strictly adhered to of all Islamic practices. This may in part be attributed to the numerous community activities involved in the observance of this fast which place a strong pressure on all to conform. To fast during Ramadan is considered a yearly reaffirmation of one's allegiance to Islam; nonobservance of the fast could bring social disapproval or perhaps ostracism. Since the Moslems follow a lunar calendar, the month of Ramadan occurs at different times during the year. When Ramadan occurs during the summer and temperatures reach 100° or more, the self-discipline required to refrain from taking even a sip of water must be very great. Several other fast days exist for the Moslem, but none have as great a significance as that of Ramadan. The Koran exempts young children, the aged and sick, travelers, and nursing or pregnant women from the Ramadan fast; however, days missed because of travel, pregnancy, or lactation must be made up at a later time.

The last pillar of Islam is the pilgrimage or haji to Mecca. This trip is the height of religious exhilaration for the Moslem. Every year thousands come from all over the world to pay homage at the great shrine. In 1962 approximately 966,000 made this pilgrimage; the vast majority came from Saudi Arabia but about twenty-two percent came from other countries. The area surrounding Mecca for one hundred square miles is closed to all who are not Moslems. The Great Mosque of Mecca, which can hold over thirty-five thousand people in its court, also contains the holiest shrine of Islam, the Kaaba. The southeast corner of the Kaaba contains the Black Stone which is believed to have been given to Abraham and Ishmael by the Archangel Gabriel.

The Koran and the traditions, like the Jewish Torah and Talmud, contain statements which inform the Moslem of the clean and proper foods to eat and how they should be eaten. Animals that are forbidden are any that die of disease or strangulation or that are beaten to death. Blood is forbidden as well as swine. Islam like Judaism adopted the rejection of the pig; four passages in the Koran forbid the eating of pork. The pig is so abhorred that in some places even the word pig is avoided and he is referred to as "the black one." Simoons, in his book *Eat Not This Flesh*, reports that a pious Moslem killed by a wild boar is said to remain in the fires of hell for five hundred years to become purified. Moslems are also forbidden to partake of wine or other intoxicating beverages.

No animal food except fish and locusts is considered lawful unless it has been slaughtered according to the proper ritual which is similar to that used by the Jewish shocket. The person killing the animal must repeat at the instant of slaughter, "In the name of God, God is great."

Among the Islamic traditions one finds statements regarding how one should eat. For example, the Moslem is commanded "to eat in God's name, to return thanks, to eat with the right hand and with shoes off, and to lick plate when meal is finished." Islam makes no distinction between men regardless of wealth, social position, race, or color and encourages the practice of all types of men eating together. All are brothers united in the worship of the one and only true God.

One cannot help but be struck by the similarity between some of the ritual practices of Islam and Judaism. This may be attributed to the fact that the two religions developed in the same part of the world and to the close contact of Islam with Judaism during the formative years of Islam.

Hinduism

Hinduism, considered by some the oldest living religion, originated in India approximately four thousand years ago. Its adherents in 1965 numbered some 409 million with the vast majority of these people living in the Indian subcontinent. Although to many of us it may appear that the Hindu worships several hundred deities, this is not strictly true. These numerous gods and goddesses are all manifestations of one supreme being which the Hindu calls Brahman—the Universal Spirit. According to ancient Hindu mythology, Brahman appeared in the form of the god Brahma and created the universe. Then in the form of the god Vishnu, Brahman sustained the universe for a period of 432 million human years; eventually, in the form of the god Shiva, Brahman destroyed the universe. The universe to a Hindu is cyclic. The present world was created by Brahma. It is now approximately 425,000 years from the time when Shiva will cause the destruction of the world, thus enabling another world to be reconstructed by Brahma. The Hindu believes that nothing which once existed is ever completely destroyed, it merely undergoes a change in its form.

Brahma, Vishnu, and Shiva have been referred to as the Hindu trinity. Of these three deities, only Vishnu and Shiva are worshipped today to any large extent. In addition to these two principal deities, their are reported to be some three hundred other manifestations of these deities which are worshipped in varying degrees. Orthodox Hinduism is subdivided into six different sects; for each sect there is a particular set of deities that is considered most sacred. Most Hindus worship at least three deities: the god of his village or town, the god of his family, and a personal deity.

Intimately involved in the Hindu way of life and religion is the caste system. From ancient times the caste system has provided a means of dividing society into unalterable levels of social status depending upon birth. An individual born into a caste was destined to remain a member of that caste throughout his life regardless of his efforts to advance to a higher caste. In all societies birth undoubtedly influenced one's social status, but it was usually possible for an individual to improve his social position by one means or another. Not so with the Hindu. According to the early religious writings, four social orders or castes of Hindu society arose from the different parts of the body of Brahma. From his mouth were created the priests and teachers called Brahmins; from his arms sprang the warriors and rulers, the Ksatriyas; from his thighs came the farmers and traders or Vaisyas; and from his feet the menial laborers, the Sudras, were born. All individuals born outside these four orders were considered to have been created from the darkness which Brahma discarded in the process of creation. These people were called outcasts or untouchables. Since 500 B.C., when the caste system was known to have been in effect, the four original castes have subdivided within themselves so that today nearly three thousand different castes are said to exist.

The word caste in Sanskrit means the equivalent of race, suggesting that the caste system may have originated from the racial pride and color prejudice of the Aryan conquerors of India thousands of years ago. Whatever its origin the caste system became a basic institution sanctioned by the religion and woven into the Hindu way of life.

The members of each caste had a moral duty to perform which was unique for that caste. For each caste definite rules and regulations existed which dictated to the member whom he could marry, what he could eat, and with whom he could eat and socialize. The Brahmins occupied a privileged position in the Hindu society and were considered the highest caste. Originally the Brahmins were not permitted to engage in any type of work other than study and religious teachings. People in the other castes were expected to support and sustain the Brahmins with gifts of food or money. The ancient laws and writings sacred to the Hindu encouraged the giving of these gifts to the Brahmins, promising great benefit or merit to the giver. For example, the gift of a cow or a piece of land to a Brahmin ensured that the giver would go to heaven. In more recent times many Brahmins have abandoned the old idea of not working; today many Brahmins are engaged in the professions of law, medicine, and business. Many have positions in the government and in universities. However, they still retain their esteemed social position and rigidly follow many of the ancient practices regarding their social and home life.

The Ksatriyas, as the kings and soldiers, originally were obligated to protect the community and willingly give their lives to protect the Brahmins as well as the most sacred animal to the Hindu, the cow. The members of this caste were allowed to kill for food and were meat eaters. The duties of the Vaisyas were to make money and to improve the economic situation of the country. They were particularly encouraged to give gifts to the Brahmins and money for the building of temples. The moral duty of the Sudras was to serve the three higher classes with diligence and humbleness. This class in particular developed numerous subdivisions based mainly on various occupations such as carpenters and weavers; the profession of a Sudra had an important influence on his social status. In these early times the outcasts or untouchables were considered so lowly that they were not even allowed in the villages and towns except to do the most menial of labor. These people were not allowed to own land or to build houses and lived under wretched conditions.

The caste system of India has been likened in many ways to the social structure of Medieval Europe; the princes, feudal lords, merchants, and peasants of that period are comparable with the four main castes of India. The Industrial Revolution contributed greatly to the dissolution of Europe's caste system, but India's caste system has remained relatively unchanged over the centuries. However, in 1949, as a result of the vigorous efforts of Gandhi, the Indian government declared untouchability illegal and expressed opposition to the social barriers of caste. Social changes of this nature are accepted slowly; the caste system is still a forceful factor, particularly in the villages, and affects the lives of millions of Indians. Whether the caste system can survive the increasing industralization of India and the increasing mobility of Indians from the villages to the cities is a question that cannot be answered at the present time.

Fundamental to the Hindu religion are the ideas of reincarnation and destiny. To a Hindu his present existence is but one of many. After death his soul is liberated and eventually takes birth again in another form. Thus the Hindu goes through endless cycles of birth, death, and rebirth. The ultimate goals of the Hindu are to attain liberation from this cycle and to gain complete self-identification with the Universal Spirit, Brahman. The form the soul takes at rebirth is the direct consequence of a person's actions during his previous life. If a Hindu, whatever his caste, performs his moral duty well and is pious during his present life, he may be reborn in a higher caste. On the other hand, if he does not behave according to his moral code, he may be reborn at a lower level of existence, either human or animal. Thus every thought and deed committed by a Hindu are his own responsibility and he alone must reap the consequences. This philosophy justifies to the Hindu all the inequalities of life, including the caste system. What a

Hindu is in his present life is the direct consequence of his actions in a previous existence, and his next life will be largely determined by his present actions.

To the orthodox Hindu, Brahman is all and everything. All living things contain a part of this divine spirit. Thus all life is sacred. To take the life of even the smallest creature is tantamount to causing harm to a part of Brahman. The belief in reincarnation also contributes to the Hindu's abhorrence of the taking of life since he could never be sure that any animal he killed did not contain the soul of an ancestor reborn as that animal.

Of the numerous writings sacred to the Hindu, the Code of Manu contains many references which have an influence on the diet of the Hindu. A few examples follow:

> *Wound not others, do not injury by thought or deed, utter no word to pain thy fellow creatures.*
>
> *One should cease from eating all flesh. There is no fault in eating flesh, nor in drinking intoxicating liquor, nor in copulation, for that is the occupations of beings, but cessation from them produces great fruit.*
>
> *Meat can never be obtained without injury to living creatures, and injury to sentient beings is detrimental to the attainment of heavenly bliss.*
>
> *There is no greater sinner than that man who, though not worshipping the gods or the manes, seeks to increase the bulk of his own flesh by the flesh of other beings.*

Most pious Hindus, especially those of the Brahmin caste, are strict vegetarians who follow the nonviolence attitude and strict rules of the Code of Manu. The more devout Brahmins deny themselves eggs as well as all forms of meat since to eat an egg would be equivalent to taking a life. The members of the other castes may eat meat other than beef, but prejudice against this practice increases the higher the caste. The particular god which a family worships may influence whether they eat meat. Although the avoidance of pork and chicken in the diet is undoubtedly influenced by the religious attitude of the sanctity of life, it is also due in part to the idea that these animals are scavengers and thus unclean. Fish is consumed by some Hindus, particularly those in the area of Bengal.

Although all animals contain a part of Brahman and are sacred, the cow has been singled out as a particularly sacred animal. The exact reason for this is not clear. Records dating back hundreds of years before the birth of Christ indicate that cattle were slaughtered and eaten in India. However, the code of Manu, written sometime between 100–300 A.D., listed the slaying of cattle as an offense requiring penance. One can at best only speculate on the reasons for this change in attitude. It has been suggested that the cow took on a sacred aura because of his years of faithful service in helping man till the soil and providing him with food to feed his family as well as fuel, in the form of dried cow dung, to heat his home and cook his food. It also has been suggested that the killing of cattle was prohibited to encourage the development of agriculture and the planting of crops for food.

According to Hindu mythology, the cow was created by Brahma on the same day as the Brahmins and thus is an animal to be venerated above all others. In fact, one of the several Hindu heavens is named after the cow. The cow has become the symbol of motherhood in India. Mahatma Gandhi referred to the cow as a poem of pity and the mother to millions of Indian mankind. The early scriptures admonish "all that kill . . . cows rot in hell for as many years as there are hairs on the body of the cow." Thomas reports that no devout Hindu will pass a cow without touching it and then touching his own head. The act of feeding a cow brings great merit to a Hindu. The cow is sacred to all sects of Hinduism and to all castes. Cows wander at will through most towns and cities of India, often causing considerable damage to crops. In 1956 India had 159 million cattle, one-fifth of all the cattle in the world. Many of these cattle were diseased and unproductive; perhaps of even more serious consequence, they were either consuming or destroying food needed by the people. Every conceivable means is used in India to protect the cattle from harm and slaughter. The Indian government in 1965 supported sixty-two special farms for old, infirm, and unproductive cattle.

The kitchen in a devout Hindu Brahmin home is sacred. Since all food contains a part of the Universal Spirit, Brahman, it must be prepared and consumed with proper reverence. The women who prepare the meal, as well as any who partake of it, must first purify themselves by means of ritual bathing of the entire body and often by putting on clean clothes. A Brahmin usually does not accept cooked food from a member of any lower caste but he will accept uncooked food. Even the shadow of a lower caste person falling on the food of a Brahmin is said to render it unfit for eating.

Ghee (clarified butter) and milk coming from the cow are sacred foods. These ritually pure foods cannot be contaminated even by the touch of someone from the lowest caste. Thus a Brahmin may accept milk or any food provided it is cooked with ghee from a Sudra. This sacredness of milk is evidenced also by the fact that in some Indian villages milk is sprinkled inside a house in which a child has died of smallpox. The purifying effect of the milk is believed to make the house safe.

Ghee is preferred over all other animal fats. Although the Sepoy rebellion in 1857 was due to many factors, one cause was the aversion that the soldiers had to other animal fats. A new rifle requiring greased bullets had been introduced into the army. The tips of these bullets had to be bitten off before the gun was loaded, and the soldiers rebelled at the taste of the animal grease.

The coconut is another food considered sacred. It is used as a symbol of Shiva, the three eyes of the coconut being associated with the three eyes of Shiva. To be successful all new enterprises should be started by breaking a coconut.

Meat, especially beef, is not the only food that is taboo to the orthodox Hindu. The Code of Manu forbids to the higher castes the eating of domestic fowls, onions, garlic, turnips, mushroms, and salted pork. The association of blood with the color of some lentils and tomatoes has made these vegetables unacceptable to some castes.

The Hindu has many days of fasting and prayer called Vratas. On these days he is expected to observe either a complete fast or to abstain from eating cooked foods at least. The Hindu has no weekly day of rest comparable to Sunday in the Christian religions, but actually every day of the week is a holy day dedicated to one or another of the many gods. Brahmins and most women of the higher castes observe Vratas on certain prescribed days each month. To break the fast, a Brahmin has to be fed. Women of the lower castes can feed a Brahmin either ghee, coconuts, fruits, or some uncooked food.

Buddhism

Buddhism originated during the sixth century B.C. and, in many ways, was an outgrowth of Hinduism. Siddhartha Gautama, who was to become Buddha—The Enlightened One—was raised as a Hindu, the son of a wealthy Himalayan chieftain. At the age of twenty-nine, discontent with his luxurious life and deeply troubled with the misery and suffering of mankind, he renounced his worldly possessions and assumed the role of a beggar. He wandered throughout India seeking the advice and counsel of the wisest teachers and scholars as to the universal cause of misery and how it could be removed. For six years he denied himself friends and the comforts of adequate food, shelter, and clothing while he devoted his time to meditation on how misery and suffering could be abolished. On a night in May on which the moon was full, he seated himself under a bodhi tree and passed into deep meditation. Legend has it that he was overcome by a deep mystic rapture that lasted forty-nine days—enlightenment was captured and Gautama became Buddha. In the Deer Park of Sarnath near Benares, India, Buddha delivered his first sermon on "Setting in Motion the Wheel of Righteousness." For the remainder of his life he traveled throughout India teaching the Middle Way. In 250 B.C. Buddhism was made India's state religion. Although today less than one percent of India's population is Buddhist, Buddhism is the predominant religion in Ceylon, Burma, Thailand, Laos, Cambodia, and Japan. Its adherents numbered some 165 million in 1965.

Buddha taught that ignorance produces selfish desires which are the cause of rebirth, and it is this rebirth that causes sorrow and suffering. Man passes through many cycles of birth, growth, decay, and death. These teachings are embodied in the Four Noble Truths which state that:

1. Existence is suffering.
2. This suffering is due to selfish desires.
3. The cure of suffering is to destroy these selfish desires.
4. This cure can be accomplished by practicing the Eight-Fold Path: right belief, right thought, right speech, right action, right means of livelihood, right exertion, right remembrance, and right meditation.

By following this Eight-Fold Path, man can gradually in his life after life on earth attain liberation from rebirth with its inevitable suffering and finally reach Enlightenment or Nirvana.

Basic to the understanding of Buddhism is the doctrine of Karma. Karma means literally "action or deed," but it implies both cause and effect. Briefly it means that what a person is today is the result of the sum total of his actions or deeds in a previous existence. This is the Buddhist's answer to the apparent injustices of his present life. If a man is born a cripple or poor or rich, he must simply suffer or enjoy the consequences because he alone is responsible. Every man is thus the master of his life to come. In order not to be reborn in a lower form or as a nonhuman but rather in a higher state moving slowly toward Nirvana, the Buddhist vows to follow the Eight-Fold Path including "right action." He vows to abstain from killing or doing injury to any living being, from stealing, from false-hood, from drinking intoxicating beverages, and from sexual misconduct. By the practice of "right action" the Buddhist gains and acquires the merit that will help him progress toward a higher existence in the next life. The accumulation

Buddist monks are completely dependent upon voluntary contributions of food from the village people. (Collections of the authors)

of merit is paramount in the life of a devout Buddhist. Violation of these vows brings demerit. If demerit is accumulated in excess of merit, it may result in rebirth at a lower level.

The building of merit is accomplished through voluntary gifts without thought of immediate personal gain. By making a self-sacrificing gift to a beggar, the Buddhist shows that he is concentrating on someone other than himself and is not overly concerned with the accumulation of worldly goods.

Buddhist monks hold a very special role in the attainment of merit. The Burmese monk is considered by the villagers of Upper Burma to be the embodiment of all that is good and noble in man and one who is definitely on a higher level of existence. Thus the custom of helping to feed and support a man of such exemplary conduct is considered natural and a high form of merit making (Kutho). The Buddhist monk vows not to eat after midday although he is allowed to drink tea and and coconut milk. He pledges to remain aloof from all women. His worldly possessions are the three cloths that he wears, a begging bowl, a razor, a needlecase, a mat, and a small cloth used to filter his drinking water. Buddhist monks are completely dependent upon voluntary contributions of food and clothing from the people. Every morning the yellow-clad monks with their iron or brass beggar's bowls silently make the rounds of the houses in the villages. The monks are not allowed to announce their arrival in any way or give any thanks for food received. The woman of the house gives the very best of what rice, curry, or fruit she has available. (See the picture on page 151.)

In the cities or larger towns in Thailand the monks' meals may be prepared from food sent to the monastery by wealthy Buddhists. Some village households may send additional food to the monastery for the monks' midday meals. In fact, one hour before noon a temple drum may be sounded to warn those who want to send food that the hour is approaching. Many families might not normally eat a meal at noon themselves but still would prepare food to be sent to the monks. In some northern Thailand villages, the monks no longer beg for their food each morning. Instead a section of the village, consisting of sixteen or so households, is assigned the responsibility of providing sufficient food for the monks on a particular day. The food is brought to the monastery early in the morning by the women and girls of the households. The monks are served by temple boys. Additional food also might be sent to the monastery on special holy days, and the monks might be invited to eat with a family on important family occasions.

The cost of maintaining the monks might represent an economic hardship in the eyes of a Westerner. DeYoung estimates that there were probably 400,000 Thai males in monasteries in 1955. Village boys in Thailand usually become temple boys at about the age of ten. In this capacity they act as attendants to the monks and, in return, are taught to read and write and to learn some of the Buddhist scriptures. Many boys remain in the temple and qualify for novicehood. In Burma parents are expected to sponsor their sons for novicehood. This is one of the highest forms of earning merit; the boys are encouraged to enter the monastery in order to provide their parents with the opportunity to obtain merit. The length of stay in the monastery may vary from only a few days to several months or a lifetime.

DeYoung estimates that the amount of food contributed to the monastery by each household in a Thai village in a year's time is probably equivalent to the cost of feeding one additional person for a year. Assuming that an adult male consumes approximately one pound of rice a day, this amounts to at least three hundred and sixty-five pounds of rice a year or approximately ten dollars.

Kutho, or merit, in lesser amounts can be obtained by giving food to nuns and beggars. Food is always offered immediately to a visitor in a Burmese home. To not offer food is thought of as not the "right action" and is a source of Akutho or demerit.

The vow to abstain from taking life is reflected in countless ways in Buddhist countries. The growing of rice and other crops is regarded as the "right livelihood" because it does not directly involve the taking of life. Attempts to introduce the growing of ground nuts have been successful for this reason, whereas attempts to increase the production of livestock, such as pigs and chickens, have met with limited success. Pigs raised by villagers in Thailand usually are sold to a Chinese dealer for slaughter and marketing. In Thailand a villager must buy a permit to slaughter a pig. Chickens are raised for sale by nearly every farm household in Thailand, but most farm families do not eat more than four or five chickens a year.

However, the vow to abstain from taking life is not rigidly adhered to as evidenced by the fact that fish is a common supplement to the Thai rice diet. According to Pfanner, Thai villagers reason that they do not kill the fish, they simply remove them from the water. In a Burmese village a government program to control rodent destruction of ground nuts by use of rodent poison was accepted. In anticipation of resistance to the program the government declared that any Akutho earned by killing the rats would come to the government and not the farmer. Most farmers, however, adopted the attitude that killing the rats was necessary; that by doing this, more money would be earned from the sale of ground nuts. The increased income could then be used to help acquire Kutho, thus balancing any Akutho gained by killing the rats.

POSSIBLE ORIGINS OF RELIGIOUS DIETARY PRACTICES

From the discussion of the five selected religions, it can be seen that they all prohibit some food either completely or on certain days. In every case these foods are of animal origin. For certain groups in the Hindu society and for Buddhists, no meat of any kind can be eaten; for all Hindu castes beef is especially tabooed. The eating of pork or blood is considered despicable to the Orthodox Jew or Moslem. If the adherents of the Eastern Orthodox Church abstain from meat, fish, and dairy products on all the indicated days of fast, these foods could not be eaten on about one hundred and thirty-six days out of the year.

In almost every religion, statements of one type or another pertaining to man's diet can be found in the sacred books and writings. Because these dietary regulations were actually written down in these sacred books, which were often considered the word or will of the supreme being, the regulations have been preserved and perpetuated over the centuries. The religion itself has encouraged and contributed to the continuing observance of these dietary habits from the earliest times. However, this does not explain why the particular dietary practice came to be a part of the sacred writings of the religion. The real origins of these dietary practices are lost in antiquity; today one can only suggest possible reasons as to why these practices developed.

Man's environment prior to the development of each religion and the writings of the sacred books must surely have influenced his dietary habits. The founders of the various religions may have incorporated already existing dietary habits into the religion. Primitive man was oppressed by hunger and consumed almost any food that he could obtain. Usually no choice was involved. It was more a question of food for survival. Simoons suggests that the original prejudice against the pig developed among the pastoral peoples living in the arid regions of Asia. The pig was not a commonly eaten animal in their group but was in the diet of those who settled permanently in the area. Contempt for the food of the rival group may have made the pastoral people ridicule the eating of this animal; thus the prejudice was established and may then have been incorporated into the sacred writings. The similarity between the dietary practices of Islam and Judaism suggests that Mohammed may have been influenced by the existing practices of the Jews.

An example of a religious festival which was practiced before the Old Testament was written and is still practiced today is the Jewish Pesach. The origin of the present-day Pesach festival, as related by Schauss, is really the combination of two festivals that were observed by nomadic Jews long before their deliverance from Egypt. The Festival of the Shepherds was one of these. It was observed in the spring when the kids and lambs were born. On the night of the full moon just before dusk, a sheep or goat was sacrificed and the animal roasted whole. All the family members had to consume the animal completely that night since it was forbidden to have any of the uneaten meat left by daybreak. One ritual associated with this festival was to mark the tent posts of all who partook of the feast with the blood of the slain animal. The other early festival was called the Festival of Matzos (unleavened bread). This festival also occurred in the spring at the time of the cutting of the barley and lasted about seven weeks until the wheat was harvested. Prior to the harvest of the barley, the Jews removed from their homes any old bread or fermented dough. The first barley cut was given to the priest as a gift to God. This latter festival was a command festival conducted in a place of worship.

Schauss states that over the centuries, as the Jewish people settled in towns and cities, the meanings and relevance of these early customs became obscure to the new generations. The Jews retained the old customs but reinterpreted them and gave them new meaning and emphasis. Pesach thus became the festival which allowed each Jew to commemorate and relive the deliverance of the Jewish people from bondage in Egypt. Thus the eating of the matzos during Pesach is retained but not to assure a good harvest of wheat. Instead it is eaten to commemorate the fact that the Jews did not have time to allow bread dough to rise and so baked unleavened bread on the night they fled from Egypt. It seems inevitable that this sort of reinterpretation and reevaluation of the many customs and rituals in all religions must have occurred over the centuries since their founding. The recent decree which allows Roman Catholics to eat meat on Friday if they so choose is an example of this reevaluation process.

The fear of disease has been suggested as a possible reason why the early Jews, Moslems, and Hindus rejected the pig. This animal was a scavenger and may have been considered unfit as food since he ate all kinds of filth. The relationship between trichinosis and the eating of pork is well known to us today, but it is doubtful that early man knew of this relationship. It is possible that he did recognize a connection between the eating of pork and vomiting and diarrhea which are early symptoms of trichinosis. But Simoons points out that these symptoms of trichinosis occur in only about five percent of the cases. Undoubtedly the problem of preserving meat and dairy products for the early Hebrews and Moslems was great, particularly with the climatic conditions of their environment. Spoiled meat was inevitable if it was not consumed rather quickly, but this would be true of all meats and not just pork.

Early man, as well as many groups of primitive people today, worshiped and regarded as sacred certain animals. This practice is referred to as totemism. Why a particular animal is singled out is unknown. It may be through fear or because of the pleasant association man has with a certain animal. The latter reason is the one most often suggested as to why the cow is a sacred animal to the Hindu. In many African tribes cows usually are not killed and eaten but are kept as status symbols and an indication of wealth.

Certain dietary practices may have developed as a means of separating one religious group from another. Simoons suggests that the rejection of pork by the Moslems was adopted by Mohammed to distinguish Islam from Christianity. As pointed out earlier, various dietary practices may have originated to provide an effective way of holding the members of a religious group together. The observance of these practices in their everyday life gave a common bond to the group which, in turn, strengthened their religious beliefs.

THE FUTURE RELATIONSHIP

Since the early beginnings of each of the five religions discussed in this chapter, food has played an intimate role in the manner by which man has attempted to relate to his supreme being or supernatural power. For hundreds of years within each religion, the numerous symbolic ways of using food has had deep meaning to man. It is perhaps not surprising that food, so necessary for physical well being, should also have been used to attain spiritual well being.

Most of the discussion in this chapter has been concerned with the relationship of religion, food, and man as it has existed in these religions. But what of today and tomorrow? Are these religions having as great an impact on the dietary practices and habits of their adherents as they had in the past? The abolishment of the church law directing Roman Catholics to abstain from eating meat on Fridays and other fast days, the large number of Reform Jews in the United States who do not observe the Laws of Kashrut, and the custom of many Greek Americans to observe only a seven-day fast before Easter and Christmas instead of the forty-day fast suggests that, in the United States at least, the influence of certain religions on the dietary habits of their adherents is not as strong as it was. The situation in other countries is difficult to determine. If in the future the role of food in religion decreases, will man need to replace the spiritual values he once received from the observance of certain religious dietary practices with something else and, if so, with what?

STUDY QUESTIONS

1. What similarities and differences have the religions discussed made on the food practices and customs of their adherents?
2. What are the religious bases or reasonings for the various food practices and customs listed in Question 1?
3. What values have certain religious dietary practices had in the past to their adherents? Do you think that these values are important today? Why?
4. Roman Catholics have recently been given the opportunity to choose some other way of doing penance than abstaining from meat on Fridays. What are some of these choices? How widely have these other ways of doing penance been adopted by Catholics?
5. Why is the cow a sacred animal to the Hindu?

TOPICS FOR INDIVIDUAL INVESTIGATION

1. Two Protestant religions which have a strong influence on the dietary practices of their members are the Seventh-Day Adventists and the Church of Jesus Christ of the Latter-Day Saints. Discuss what these influences are and the religious bases for these influences.

2. Examine in detail the religious influences of Shintoism and Confucianism on the dietary habits of their adherents.

3. Discuss how the tribal religions of various American Indian tribes influenced their dietary habits and agricultural practices.

4. Discuss the influences that some tribal religions of Africans have had on the production, distribution, and consumption of food.

5. Interview a Hindu, a Moslem, an Orthodox and a Reform Jew, and a member of an Eastern Orthodox Church to determine what influence their religions have on their own dietary habits. Does the observance of these practices have certain values for them? If so, what? What are some difficulties they encounter in following these practices?

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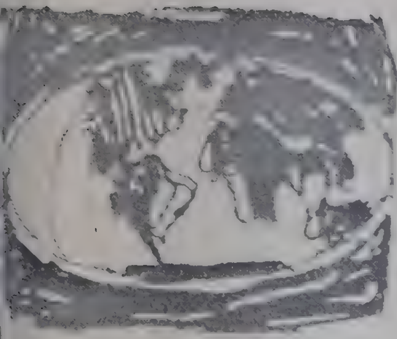

HUNGER AND ITS EFFECTS ON PEOPLE

Hunger is a condition of misery and suffering, a condition of human degradation. The effects of it reach around the world—to those who suffer its wretchedness and also to those who escape it—for hunger is the concern of men of goodwill everywhere.

Hunger is not an uncommon condition. In 1966, Fischnich of the Food and Agriculture Organization reported that twenty percent of the people in the less-developed areas were hungry and that fifty percent manifested evidences of specific nutritional deficiencies. When we realize that food production in these areas is barely keeping abreast with the population increase, we have reason for concern.

The effects of hunger on the physical condition of individuals, the behavioral changes observed during experimental hunger, and the possible influences of hunger on mental development will be dealt with in this chapter. Causes for the existing prevalence of hunger will be discussed, as well as some programs

Hunger—a condition of misery and suffering, of human degradation. (Courtesy of Agency for International Development)

now in operation in various countries aimed at lessening the incidence of hunger.

THE TERMINOLOGY OF HUNGER

Thus far we have spoken only of hunger. A term used synonymously is undernutrition. Both are interpreted to signify the effect of the intake of an insufficient quantity of food. The energy value of the diet is the limiting factor in hunger and undernutrition.

When the deprivation is so extreme that little flesh remains on the bones, giving even the young a wizened and old appearance, the condition is called *marasmus*.

When there is an inadequacy in the nutritional quality of the diet, deficiency of certain nutrients such as protein, minerals, or vitamins, the term malnutrition is used. Undernutrition and malnutrition are not mutually exclusive; people who are undernourished also may be malnourished. Malnutrition is discussed in Chapter 7.

EFFECTS OF HUNGER ON PHYSICAL STATUS

The effect of hunger on individuals is variable. The response depends on the duration and severity of the lack on the one hand and on the capacity of an individual to adjust to the deprivation on the other.

Growth

Failure to thrive is a sensitive indicator of undernutrition in the young. Children who grow in spite of hunger grow less and so are smaller than well-nourished children of the same age. Economically disadvantaged children, children who live in parts of the world where there is a shortage of food, and children who suffer the results of war and disaster reflect the stunting effect of insufficient food. Meredith of the University of Iowa examined a dozen research studies dealing with growth and economic level. The pattern common to all was that the children of higher-income families were taller and heavier than their counterparts in the lower-income groups. Thus the children whose parents were in professional and managerial positions were larger than the less economically well-off children of the unskilled and semiskilled workers. And the children who were in school in the better residential districts were larger than the children in schools in the poorer residential areas.

Infants and young children in developing countries present dramatic, even though at this moment rather indirect, evidence of the effect of nutrition on growth. Breast-fed infants in developing countries grow in the early months of life at a rate within the norms established in the United States. However, a break in the growth rate occurs after six months of age, with the rate falling below the United States standards. The cause is believed to be lack of proper food. This pattern was observed in the children of Lebanon. A survey of child-feeding practices in all parts of Lebanon revealed that at six months of age ninety percent of all infants were at the breast. By one year of age many had begun to sample adult fare and by the age of two years were on it completely. At six months of age the infant needs foods in addition to the breast milk which these infants were not receiving. At one year of age they were getting supplemental fare, but these foods were lower in nutritive value than breast milk and often were carriers of infectious microorganisms.

Experimental studies with animals extend our information on the physical effects of hunger. To be sure, it is always a question as to whether the findings apply to the human, but they at least can be considered indicative. When the diet of experimental animals is restricted so that the body weight is held constant, certain parts of the body are found to persist in growth. In studies using dogs as the experimental animals, the dogs were found to grow longer and taller and leaner. In recent studies with pigs and chicks, McCance and his co-workers in England found the weight of the bones, the heart, and the brain to increase in spite of the stationary body weight.

There is the continuing question as to whether restriction of food intake in early life affects the ultimate size attained. Studies with rats restricted throughout the nursing period showed that they never achieved normal size. The capacity to grow was maintained but not at a rate sufficient to make up for the early period of deprivation.

Body Composition

During hunger there is a loss of fat and protein from the body and an accumulation of water. In the classical Minnesota study of the effects of semistarvation, thirty-two young men consumed a diet of 1570 calories over a period of twenty-four weeks; fat and protein were lost from their bodies. During the first few days of the restricted diet, there was considered water loss. This loss decreased with the progress of the experiment, reaching a point where there was water retention (Table 1). It has been observed that in severely malnourished infants the water content is approximately eighty-five percent of the body weight, whereas the normal percentage is around sixty-five.

Bones too change in composition with hunger making them more fragile. Radiographs of ninety-five infants and children hospitalized in Guatemala City with protein-calorie deficiency showed a picture of juvenile osteoporosis. It is the type of weakening observed in animals with experimentally produced protein-calorie deficiency.

Pregnancy

Fertility does not appear to be impaired by undernutrition. Casual observations indicate this situation and demographic studies give circum-

TABLE 1. COMPOSITION OF BODY WEIGHT LOSS AT SUCCESSIVE PERIODS OF UNDERNUTRITION (MEAN VALUES)

	Percentage of Total Loss in		
Days	Fat	Protein	Water
	Experiment—53 Days		
1–3	27	9	64
4–6	40	10	50
7–12	53	13	34
	Experiment—54 Days		
1–3	25	5	70
11–12	69	12	19
22–24	85	15	0

From: A. Keys, Undernutrition, *in Duncan: Diseases of Metabolism, 5th Ed. W. B. Saunders, Philadelphia, p. 681, 1964.*

stantial evidence of it. In the developing countries where hunger exists, the annual birth rate was estimated to be about forty per one thousand population in 1963. In the other countries of the world the annual birth rate was estimated to be about seventeen per one thousand population.

During World War II a careful study of the problems of fertility and pregnancy in relation to nutrition in the Colony of Singapore was made. Food was scarce and expensive. There was no evidence that fertility was reduced. However, when the deprivation was near starvation in Rotterdam and The Hague in the winter of 1944 and the spring of 1945, amenorrhea developed in about one-half of the women, with a consequent fall in the birth rate due to a lower rate of conception.

If fertility persists in spite of hunger, it is logical to question the effect on the infant born. The infants born to severely deprived mothers in Holland in 1944–1945 were small. In general it seems that the baby of an undernourished mother is on the whole surprisingly normal but small. The socio-economic level is reflected in the birth weight within ethnic groups (Table 2). Although other factors are involved, it seems safe to conclude that the amount of food eaten by the mother is important in the difference between the birth weights of babies of the well-to-do and the poor.

It may well be asked if small birth weight has any significance for the

TABLE 2. MEAN BIRTH WEIGHTS ACCORDING TO SOCIO-ECONOMIC STATUS

Place	Population	Subjects	Mean Birth Weights (grams)
Madras	Indian	Well-to-do	2985
		"Mostly poor"	2736
South India	Indian	Wealthy	3182
		Poor	2810
Bombay	Indian	Upper class	3247
		Upper-middle class	2945
		Lower-middle class	2796
		Lower class	2578
Calcutta	Indian	Paying patients	2851
		Poor class	2656
Congo	Bantu	"Very well nourished"	3026
		"Well nourished"	2965
		"Badly nourished"	2850
Ghana (Accra)	African	Prosperous	3188
		General population	2879
Indonesia	Javanese	Well-to-do	3022
		Poor	2816

From: World Health Organization. Nutrition in Pregnancy and Lactation. *Tech. Rept. Series No. 302. Geneva, Switzerland, p. 14, 1965.*

later well being of the child. A followup study was initiated in 1959 in Wake County, North Carolina, by Robinson and Robinson. The children studied were eight to ten years of age. By that age, twenty-four percent of those who had birth weights significantly less than normal suffered major physical defects; the incidence in other groups was only two to three percent.

Stillbirth and neonatal death rates also vary with socio-economic levels. Where the standard of living is high, the rates are low; where the standard of living is low, the rates are high. Poor nutrition is believed to be a responsible factor in the high incidence of stillbirths and neonatal deaths among those with low standards of living. However, the World Health Organization Expert Committee on Nutrition in Pregnancy and Lactation indicates that it is not easy to demonstrate the "precise role of nutrition in toxemia except to state that the nutrition status of the patient may possibly modify the course of the disease."

The British investigators Thomson and Hytten believe that nutrition in childhood influences the incidence of stillbirths among women. They use demographic data of Britain as their guidelines. They begin with the 1930's when there was a period of substantial unemployment; malnutrition was prevalent among the poor. During the subsequent war years, the rate of stillbirths fell from thirty-eight per one thousand in 1940 to twenty-eight per one thousand in 1945. During this period there was food rationing, and pregnant and lactating women were given priority on supplies of protective foods, cheap or free milk, and vitamins. The authors believe that the good diet accounted for the fall in the rate of stillbirths. During the ten years following World War II, there was little change in the rate of stillbirths. There was economic austerity after the war, but the authors believe that the nutritional status of women during pregnancy and lactation did not suffer. In recent years the stillbirth rate in Britain has been falling rapidly again.

Thomson and Hytten do not present a certain explanation for the current fall in the rate but do present an hypothesis. The basis for their proposal rests in part on the findings of an earlier work of Thomson in which he studied four hundred and eighty-nine women in Aberdeen, Scotland. He divided them into two groups, those with normal and those with abnormal clinical histories. Undernutrition was not found to be related to obstetrical performance; however, there were indications that stature of the mother did bear a relationship. The authors hypothesize that girls who are reared under favorable conditions and have a good diet "attain a high level of health and physiological efficiency" by the time they bear children; on the other hand, those who are stunted due to malnutrition fail to attain their full adult size. Thomson and Hytten point out that the mothers of the 1960's grew up after World War II. They are taller and heavier than those who grew up before that time. Other earlier studies have shown also that short women have higher rates of stillbirths than do tall women.

One last point about pregnancy which is of particular importance for the undernourished women is the capacity of the body to use more efficiently the food nutrients provided to it during this period. As indicated from studies of nutrients, protein, calcium, and iron, a higher percent is absorbed from the gastrointestinal tract and more retained in the body by the pregnant woman than by the woman who is not pregnant. Such studies have not been done with the undernourished woman. However, it is safe to assume that there are minimal levels of need which, if not provided, would harm the mother or the unborn child.

Work Capacity

Significant anywhere, but particularly in developing countries, is the adverse effect of hunger on work capacity. The debilitation of undernutrition has been observed under naturally occurring conditions and has been explored under conditions imposed in the experimental laboratory. Hunger lessens the work capacity of man.

Keller and Kraut studied the coal miners of the Ruhr district of Germany during and immediately following World War II. In 1939, when the rations provided an average of 4500 calories, approximately 2300 calories of this amount remained for work after the requirements for basal metabolism and other activities were fulfilled. The daily amount of coal removed by each miner was 1.9 tons. In 1944, when only 1900 calories were available for work, 1.65 tons of coal per man were mined. Workers in a steel plant were also studied. In 1939, when the worker's rations supplied 1900 work calories daily, the steel production amounted to more than 120 tons per man per month. However, in 1944, when only 1150 calories were available daily for work, production was less than 80 tons monthly per man.

The men in the experimental study of semistarvation carried out by Ancel Keys and his co-workers at the University of Minnesota, suffered a marked loss of physical strength and endurance during the twenty-four week deprivation period. Voluntary exercise became less with the progress of the study. The men felt weak and tired. Although they moved cautiously, they bumped into objects and tripped over things.

The behavior of troops on short rations while in field operations reveals the incapacitating effect of too little food. Kark tells of the controlled study carried out in 1942 in the Canadian Arctic as follows:

> *One company was given an excellent ration, the others lived on calorically deficient rations. By the end of the week it was obvious to us that those living on the poor rations were deteriorating, but all the measurements we made could not distinguish between the three companies. Then after a particularly grueling day they came into the bivouac area for the night, cut down spruce trees for their shelter, ate supper, and bedded down. The next morning, after they had left, we found that each platoon of the well-nourished troops had built proper shelters to protect them from the wind and the cold. The platoons of the next best nourished company started to build shelters, but halfway through they were so tired that they stopped. The most caloric deficient soldiers*

> *were so tired when they came into the bivouac area that they just took spruce branches, laid them on the ground and slept unprotected.*

Infection

A common affliction of the hungry is infection. In parts of the world where the incidence of hunger is high, the incidence of infections is also high and the outcome more grave than among the well nourished.

Infantile diarrhea is an example of the causal relationship of hunger to disease. The undernourished child is more susceptible to diarrhea than the well-fed child. The diarrheal condition then increases the severity of the undernutrition because the rapid passage of material through the intestine does not permit the absorption of nutrients to occur as under normal conditions.

Diarrhea, the primary cause of infant mortality in developing countries, increases in incidence markedly at the time of weaning. This almost universal association has led to the adoption of the term "weanling diarrhea." The replacement of mother's milk by food less nutritionally adequate and likely a carrier of infectious microbes is believed to be a causative factor. Further evidence of the role of nutrition was the decrease in the incidence of diarrhea among children under five years of age when supplementary food was given to them. In the Mayan Indian highland village of Santa Catarina Barabona, Guatemala, the children received four days each week a supplement of milk, a banana, and a special cereal mixture fortified with yeast, calcium, and vitamin A which supplied an additional fifteen grams of protein and 450 calories. The mortality rate of the children of this village was notably less than that for the children of Santa Cruz Balanya who received no supplements (Table 3).

TABLE 3. MORTALITY RATES PER THOUSAND: MAY 1959–APRIL/MAY 1963

Village	Mortality Rate	
	Age 6–18 Months	Age 19–36 Months
Santa Cruz Balanya (control)	96.6	25.2
Santa Catarina Barabona (feeding)	30.3	10.4

From: N. S. Scrimshaw. Primary Deterrent to Human Progress. Pre-School Child Malnutrition. *National Academy of Sciences, National Research Council, Washington, D. C., p. 70, 1966.*

The incidence of diarrhea in undernourished children is not only higher than in normal children but fatalities from it are also higher. In 1956 in Mexico City the fatality rate in children hospitalized with diarrhea was fourteen to fifteen percent in those without evidences of undernutrition and as high as fifty-two percent in those severely undernourished.

In seeking some solution for the tremendously high incidence of infant mortality from diarrhea in developing countries, Dr. Sabin looked back into the history of this malady in the United States. As late as 1920 the death rates due to diarrhea in New York City were comparable to current rates in many Latin American countries. An extraordinarily low level of diarrheal death in infants, however, was achieved in the United States and Canada by 1955. This reduction was associated more with other improvements in the standard of living than with the mere provision of pure water and sanitary disposal of excreta in the homes because these sanitary installations were already in existence in New York City before 1920. Sabin, searching for an explanation, says:

> *. . . it is necessary to ask, therefore, what public activity is most likely to contribute to a significant reduction in infantile diarrheal mortality before the great improvements in the general standards of living are achieved in the parts of the world now plagued by poverty, hunger, ignorance, and disease.*

He concludes that:

> *. . . if malnutrition during the first two years of life could be largely eliminated, and breast-feeding could be supplemented and followed by feedings free from heavy bacterial growth, there is reason to expect a very significant reduction in the current, tragic infantile mortality, even though 'dirty hands' might continue to transmit infectious agents for a long time to come.*

Organisms capable of causing diarrhea can be recovered from fecal samples in the early months of life without clinical diarrhea occurring; later diarrhea does occur. It is proposed that the status of nutrition worsens after weaning, causing greater susceptibility.

There is need for exerting efforts to maintain as sanitary conditions as possible. A rather unexpected observation is that in the majority of the infantile diarrheas, no pathogenic organism can be identified. It is hypothesized that intestinal organisms normally present and normally nonpathogenic may become pathogenic and cause diarrhea when present in abundance, as is commonly the case when the sanitation of the environment is poor.

It is believed that undernutrition is a factor in the high death rates due to measles in certain Latin American countries. This mortality rate is 418 times higher in Ecuador, 189 times higher in Guatemala, and 180 times higher in Mexico than in the United States.

On the other hand, with experimental animals under controlled laboratory conditions, a general statement that well-fed animals resist infection better than those poorly fed cannot be made. In fact, there are instances in which the undernourished animal resists the infection even better than the well-fed one. For example, riboflavin deficiency in chicks was found to increase resistance to the organism of avian malaria; folic acid deficiency in monkeys was found to increase resistance to the virus of poliomyelitis.

Adaptation

In the discussion thus far, we have examined some of the physical effects of hunger. Hunger causes stunting of growth and changes in body composition. It decreases the capacity to work and increases susceptibility to infection. But how is it that persons consuming diets grossly inadequate in calories can live and work? Actually, the body makes adjustments to maintain normality in its composition and its functioning. Cannon, the physiologist, originated the word "homeostasis" to describe "the types of arrangements by which this stabilization is accomplished." Distinguished students of the subject, Mitchell and Keys, have written extensively about it. For example, when the energy intake is inadequate, body movements are diminished. The basal metabolism per square meter of body surface is reduced. And as a consequence the total energy expenditure is lessened and the number of calories needed decreased. Keys indicates that when the weight is reduced by twenty percent from a previously normal weight, it is possible to maintain the body on a diet of approximately fifty percent of the caloric value of the previous normal food intake. This relationship between weight loss and energy reduction "explains why the rate of weight loss progressively decreases when a normal person chronically subsists on an inadequate diet and why life may be maintained for very long periods of time on a greatly reduced food intake." In the case of protein, minerals, and vitamins, when the intake is limited, the body eliminates less and retains within the body a higher percent of the amount provided in the diet.

HUNGER AND BEHAVIOR

Hunger causes changes in social behavior which are as well identified as are the physical changes. Experiments which produced hunger in man, such as the Minnesota experiment, gave researchers an opportunity to observe the deterioration in social relationships and personal adjustment with the progress of hunger. Actually, two criteria for the selection of the young men in Minnesota were good mental health and the ability to get along reasonably well with others.

Hunger changed the behavior of these young men. The clamor of it distracted them from their attempts to continue their cultural interests, normal activities, and studies. There was preoccupation with food. And when it did arrive at the two meals per day, they were torn between gulping it and consuming it slowly. There were changes in emotional reactions and attitudes. The stresses of this semistarvation regime caused instability. Periods of depression were common; gloominess permeated much of their lives; they seldom smiled. There was little humor and the negative approach to things was the common attitude.

The discrepancy between what they had once been able to do physically, wanted to do now, and were unable to accomplish was a source of great frustration to them. It was necessary to rest when ascending stairs; it was even difficult to lift the feet high enough to avoid stumbling on uneven sidewalks.

An attempt was made to relate changes in social behavior with loss of body weight. With increasing loss of weight the behavior changed from slight disorder and strife to very serious disorder, then receded to slight disorder and finally none.

Percentage loss of body weight	Civil disorder and strife
5	Slight
10	Moderate
15	Serious
20	Very serious
30	Moderate
40	Slight
50	None

Although most of the time the men were silent and sad, as the deprivation progressed there were periods of a few hours or a few days when they felt elated. Some thought that they finally had adjusted to the ration and expected that the state of elation would continue. But it did not. The weather affected moods notably. Warm, sunny days brightened the spirits; cold, damp, cloudy days caused greater depression.

The sociability of the men changed greatly. In general there was a feeling of animosity toward strangers; there was a special dislike for those who had food. It became "too much trouble" or "too tiring" to contend with other people so the men became more withdrawn and alone. Personal appearance and grooming deteriorated as stress progressed.

The pressure of hunger was more than some of the men could take, even though all were of the finest character. One person not only bought food but stole it as well; he was not able to continue the experiment.

The intellective capacity, as measured by psychological tests, did not change during the starvation period nor the subsequent period of rehabilitation. However, it was difficult for the men to concentrate on the intellective task at hand because of preoccupation with food.

The men described themselves during the stress of hunger, in contrast to their previous well-fed condition, as lacking in self-discipline and self-control, indecisive, restless, sensitive to noise, unable to concentrate, and markedly nervous.

During the rehabilitation period, many of the behavior symptoms of the starvation period persisted for several weeks. Similarly it is reported that after relief had come to the Belsen concentration camp in 1945 the inmates continued to steal, hide, and hoard food. At the beginning of the rehabilitation the inmates in the Minnesota project complained "without spirit, hopelessly—but later as their condition improved, their complaints became fierce, bitter and resentful."

One man in the Minnesota experiment characterized the difference between starvation and rehabilitation as "the difference between old age and adolescence."

Hingson, who headed medical teams to Liberia, Honduras, and certain Asiatic nations, observed among those peoples

> *the listlessness, the apathy, the suspicion of strangers, the lack of interest in self-improvement in adults whose life expectancy is thirty-five to forty years. I have seen little ones with the tell-tale sign of malnutrition, the distended stomach, sit for hours, as in a stupor, not romping or playing as normal youngsters. And they are marked for life by this lack if they survive disease to which they are prey. They*

> *will be as their elders, apathetic, dull and with no desire or capacity to work together to improve their lot. Persistent undernutrition indeed leaves its ugly mark, not only in the body, but on the mind and the personality.*

HUNGER AND MENTAL DEVELOPMENT

The question of the effect of hunger on mental development has yet to be explored with definitive research. But the interest now, as the 1970's approach, is high because of the possibility of mental damage to the immense number of severely undernourished preschool children in the world.

Some of the studies that will be cited here are forerunners of those to come. One is of forty-two Cape Town colored children. They were equally divided into those who were underweight and those of normal weight. Eighteen of each group were between ten months and two years of age; three of each group were between two and three years. The children were about one year of age when first seen. They were observed at six- to twelve-month intervals thereafter. At that time the head circumference and intelligence quotient (I.Q.) of the grossly underweight were less than for children of the same age of normal weight. Those characteristics of the parents were examined. No significant difference between the two groups was noted. However, there was a marked difference in the conditions of living between the two groups; those of the undernourished group were judged to be much less favorable. Stoch and Smyth who did the work point out that social conditions might affect the difference in the I.Q. between the two groups but not the difference in head circumference.

Included in a review of studies relating to the effect of undernutrition on mental development by Cousin are observations in Africa, Mexico, and Guatemala. By Gesell tests the newborn infants in each of these countries manifested scores of psychomotor and adaptive development higher in most cases and never below those of children of the United States and Europe. But by the time they were eighteen to twenty-four months of age, their performance was below that of their European counterparts. By this age the child is usually completely weaned, and a food of lesser nutritive value probably is fed with a resultant diminution or even cessation of growth in both height and weight. The coincidence of the break in the physical pattern of growth and of psychomotor and adaptive development is believed to be a matter for concern in the mental achievement of the child.

Pertinent to the question of the ill effect of early malnutrition on the functioning of the brain is this organ's unique manner of growth. In his classic work, *Measurement of Man*, Scammon expresses the growth of the body parts at different ages in percent of the total increment at maturity; the brain and its parts achieve approximately eighty percent of the total growth by four years of age.

Nutritional improvement of underfed children has been found to increase their I.Q. Improvement in the I.Q. was observed in both normal and retarded children in a study done by Kugelmass and his co-workers. However, little research has been done exploring this question, so a more conclusive statement must await further investigations.

SOME CAUSES OF HUNGER

We've looked at the effects of hunger. It is, in fact, a major cause of human suffering in the world. It degrades the human and all but precludes the achievements of excellence of which man is capable. The cause is simple—a lack of sufficient food; the solution—providing sufficent food—is difficult.

There are the problems of:

1. Increasing the production of food and controlling the rate of population increase to bring the two into balance.
2. Motivating the population to change.
3. Providing enough money to buy food.

Food Production and Population

Agricultural production increased in the world as a whole by some fifty percent in the decade between the world surveys made in 1948–1952 and 1957–1961. The percentages of increase which took place in the lesser and in the more developed regions were about equal. The manners of effecting the increase, however, were different. In the lesser developed areas it was done, for the most part, by bringing more land into production and more animals under feed. In the more developed regions the increase was achieved by greater yields from the land then under cultivation and from livestock under feed.

The picture is different, however, when agricultural production is considered in relation to population growth. There exists a marked disparity between the lesser and more developed regions in food supply per person. The rate of population growth at the turn of the century was less in the lesser developed regions, but the relative rates shifted in the 1930–1940 decade. Since that time the rate of population increase of the lesser developed regions has exceeded that of the more developed, as shown in Table 4. A continuation of the same relationship in population growth is predicted for the present decade.

The need for a better balance between agriculture production and increasing needs of the population is considered critical by students of the problem. That agricultural production can be increased notably in "production-deficit" countries has been demonstrated. In Chapter 9 the Agency for International Development programs are discussed. The program of the Rockefeller Foundation in Mexico presents a record of increasing production in the three basic food crops to the point of complete self-sufficiency; before the initiation of the program in 1943, it was necessary to import considerable quantities of each of these products.

TABLE 4. DECADE RATES OF POPULATION GROWTH BY ECONOMIC REGIONS, ACTUAL 1900–1960 AND PROJECTED 1960–1970

Region	1900–1910	1910–1920	1920–1930	1930–1940	1940–1950	1950–1960	1960–1970
				Percent			
More developed regions	9.6	9.3	10.5	8.4	3.0	12.8	12.1
Lesser developed regions*	7.7	7.1	9.2	12.8	17.8	18.3	22.4

**Asia, Africa, and Latin America.*

From L. R. Brown. Man, Land and Food. *Foreign Agr. Econ. Rept. No. 11. U.S. Dept. of Agr., Washington, D.C., p. 13, 1963.*

One of the basic problems to increased agricultural production is education. The opportunities for the rural population to study even at the elementary level are limited in developing countries. The farmer, the agricultural extension worker, the professor who teaches and does research in the universities, each is in need of expanding opportunities for study. Mangelsdorf of the Harvard Botanical Museum, speaking on "genetic potentials for increasing yields of food crops and animals," explains succinctly this urgent need. He indicates, according to the report of his presentation by Walsh in *Science*, that at present it is possible to breed superior plants but the rate at which agriculture can be improved "is dependent in no small part on the general level of literacy and education in the population and the willingness of governments to provide generous support for agricultural education and research. To change the ways of man is infinitely more difficult than to reshape our domestic animals and plants by genetic techniques."

Population, too, is an adjustable factor. In four of the most populous

Asian countries—India, Pakistan, China (mainland), and Japan—the governments have sponsored various measures aimed at encouraging limitation of births. A lowered rate of population increase is expected to aid economic and social advancement. In Japan the birth rate dropped from 30.1 per thousand population in 1945–1949 to 17.2 per thousand in 1957. The high degree of industralization and economic development and the high level of education of the people are cited as facilitating the movement in Japan.

There is concern about Latin America where the food gap is becoming the most serious in the world. Population has been increasing there at an annual rate of 3 percent, the highest anywhere, while agricultural production has been rising at the rate of only 2.5 percent. Before World War II the Latin American countries exported annually eleven million tons of grain, but now imports have reached twenty-five million tons yearly and are rising rapidly.

Education is the basic need for bringing into balance the supply of food and the demand for food. Education is a slow process but with lasting effects, as expressed by a Chinese proverb, "If you are planning for a year ahead, sow rice; for ten years, plant trees; for a hundred years, educate the people."

Motivation to Change

Change is necessary if the living conditions of the world's deprived millions are to improve. For those members of communities where poverty and hunger have long existed, they have become a way of life. People have developed attitudes, beliefs, and practices which yield to them a certain amount of security. To change these beliefs and practices poses a risk, and the person who lives in fear of starvation cannot afford "to risk new methods or new crops which some stranger tells him will give better results; he feels that he must stick to whatever he knows will feed him, however inadequately." He has learned by experience, by observing, and by doing things for himself. However, as reported in the 1963 FAO publication, *Malnutrition and Disease*, it has been shown that "once a start has been made, and the vicious cycle of poverty-malnutrition-more poverty is broken, confidence dispels apathy, activity replaces inertia and new expectations provide a continuing incentive to further experiment and achievement."

Economic gain may be an incentive for crop improvement. When a crop is grown for the market rather than for home consumption, the adoption of the new variety is usually extensive. In an Indian village studied by the anthropologist Duke, improved wheat for home consumption was not accepted happily because of the undesirable taste, whereas sugar cane, a cash crop, was quickly adopted by the people.

Competition has generally been recognized as a stimulant to change. In Latin America, farm club program results were better when the young people had separate garden plots in competition than if they worked land cooperatively. In the Nadi-ali area of the Helmand Valley in Afghanistan, agricultural fairs, accompanied by judging of orchards, gardens, and fields with prizes in the form of agricultural tools, have been very succesful.

The competitive plan for motivation does not always serve to encourage, however. In a cattle show in India, the competitors thought that all should win a prize. Those who won one year did not wish to win the next, and some were ashamed of winning at all because it appeared to them that they were selfish.

Motivating change of food habits requires thorough understanding of the people and their customs. Burgess explains beliefs about foods to be an "integral part of the whole fabric of life of the people and cannot be changed in isolation." Burgess and Dean, who edited the report of an international conference held in 1960 on Malnutrition and Food Habits, summarize the problem of changing food habits thus:

> *There is already enough scientific knowledge to bring about considerable improvement in the nutritional health of children in many parts of the world, if it could be widely applied. This knowledge cannot, however, be used where it is needed unless the people themselves want to use it, know how to do so, and are prepared to accept the changes necessary for its effective use. Unfortunately, there appear to be psychological, sociological, and cultural factors which create barriers against rapid changes in food habits, and which are less well undersood than the impersonal aspects of nutrition and malnutrition.*

In summary, it is clear from the experiences of workers in the field that if plans of motivating change are to be effective, they must take into account the cultural characteristics of the people.

Purchasing Power and Hunger

Lack of purchasing power is a reason for hunger in the face of available foods. To present the reality of this problem as it exists in various

Child feeding programs—the difference between malnutrition and good health. (Courtesy of Agency for International Development)

countries on a comparable basis, the amount of a worker's time required to earn the cost of a meal is used. In Table 5, Diet 1 is representative of diets in economically underdeveloped countries, Diet 2 of diets in countries at early stages of industrialization, and Diet 3 of diets in economically advanced countries. Each set of diets contains foods customarily used in the respective countries; the costs are based on prices in those countries. There exists, as shown in Table 5, a tenfold difference in the time required to earn the cost of a day's diet among the countries.

The imbalance between population concentration and share of the world income is a factor in the incidence of hunger in developing countries. Table 6 shows the dramatic differences existing between the regions of the world in the relationship between percentage of population and of income.

In summary, it may be said that the approach to the solution of hun-

TABLE 5. NUMBER OF HOURS OF WORK REQUIRED FOR AN AVERAGE FACTORY WORKER TO EARN THE COST (AT 1953 RETAIL PRICES) OF THREE REPRESENTATIVE DIETS FOR ONE DAY IN SELECTED COUNTRIES.

	Diet 1	Diet 2	Diet 3
Calories	2100	2500	3000
Grams animal protein	10–12	15–20	40–45
Hours of work required:			
India	2.1	2.9	4.5
Italy	1.1	1.5	3.2
Mexico	0.6	0.8	1.4
Sweden	0.4	0.6	0.9
Denmark	0.3	0.4	0.7
Canada	0.2	0.3	0.5
United States	0.2	0.2	0.4

From: Food and Agriculture Organization. The State of Food & Agriculture. *Rome, Italy, p. 108, 1957.*

TABLE 6. DISTRIBUTION OF THE WORLD'S POPULATION AND OF NATIONAL INCOMES BY REGIONS (1957–1959)

Regions	Percentage of Population	Percentage of Income
Far East (including China mainland)	52.9	12.3
Near East	4.4	1.9
Africa	7.1	2.5
Latin America	6.9	4.8
Europe (including USSR)	21.6	39.5
North America	6.6	37.8
Oceania	0.5	1.7
World	100.0	100.0*

From: Food and Agriculture Organization. Third World Food Survey. *Freedom from Hunger, Basic Study No. 11. Rome, Italy, p. 24, 1963.*

**Due to rounding, this column does not equal exactly 100 percent.*

ger rests not only in the scientific advancements in food production, population control, and improvement of economic conditions but also in the molding of old traditions to new patterns of development. Basic to attacking the hunger of the world is education, strengthened and expanded at all levels.

STUDY QUESTIONS

1. By definition, how do undernutrition and malnutrition differ?
2. Is there evidence that infection is associated with hunger?
3. What are some of the behavior changes observed in men during a semistarvation regime?
4. Is there evidence that hunger impairs fetility in the human?
5. What do research studies show as to the effect of hunger on the amount and quality of work that man is able to perform?

TOPICS FOR INDIVIDUAL INVESTIGATION

1. Prepare arguments supporting the necessity of working concertedly to free the world from hunger.

2. The body when subjected to the stress of hunger makes adjustments to preserve normality. Enumerate as many of these adjustments as possible.

3. Discuss the relationship of hunger and world peace.

4. Relate the problem of hunger and the progress toward self-sufficiency.

5. Discuss two great famines showing the social, economics, and political implications.

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7

MALNUTRITION AND DISEASE

Malnutrition is found everywhere around the entire globe. In general, however, it is found to the greatest extent where poverty is the rule and not the exception and where ignorance and superstition are rampant.

Lest you suspect that there is no cause for concern in the United States, we must remind you that malnutrition is considered a part of what has been pointed to in the Alaskan Eskimo as the health hazards seen in the rest of the United States fifty years ago. Malnutrition is also one cause for the heavy toll which diseases take in such groups as the children of migrant workers, in the American Indians, and in older citizens.

Jan Myrdal, in an article in the August 13, 1966, *Saturday Review*, threw out a challenge:

> *In the concrete world in which we live we all know which is the main conflict. The few are rich, the many are poor. The few live long, the many die young. The majority of the population of our world*

> *is starving. The majority is downtrodden, trampled upon, exploited. And this majority is becoming conscious. It is questioning the whole structure of the world society.*

It was said in 1962 at a meeting at Iowa State University, convened to discuss food as one tool in international economic development, that:

> *A substantial body of medical evidence and opinion exists showing that over large parts of the globe great numbers of people get inadequate diets, inadequate in terms of climatic environment and of the physical strains imposed upon them by social institutions and economic circumstances which are simultaneously the cause and the results of limited economic development.*

Several terms should be understood before we discuss this problem further. People who are *undernourished* are simply getting too few calories to maintain normal body weight and normal activity. The *malnourished individual* may get enough calories but insufficient amounts of needed food nutrients such as minerals, vitamins, and proteins or some of the critical amino acids in the proteins. This individual does not develop normally during the growth period and is unable at any time of life to maintain himself in good health and to resist disease.

Using any criteria which can be proposed to separate the poorly fed from the well fed of the world, it will be found that today millions of people are underfed. Malnutrition is an even more serious problem, because ignorance and superstition add to the burden of not enough food.

A group of experts from the United States Department of Agriculture prepared a world food budget for 1962 and one for 1966. After analyzing food available and used, they stated that only forty countries had adequate food supplies. These countries are largely in the temperate zones and include those in North America, the USSR, Oceania, the southern parts of South America, South Africa, and Japan, except that Japan has a low consumption of fat by choice. On the other hand, seventy countries, including countries in Latin America, Africa, West Asia, Communist Asia, and the Far East, were rated as food-deficit countries. It was estimated that two billion people, or two-thirds of the world's people, live in these food-deficit areas.

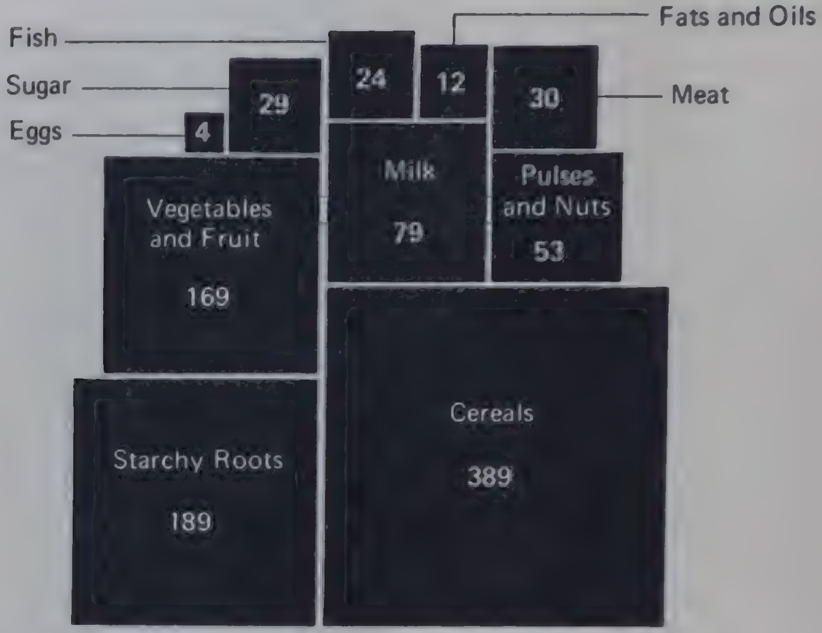
It is in this setting of not enough calories and of not enough of the right kind of food eaten that we want to discuss undernutrition and malnutrition. As we do this, we feel constrained to pay tribute to a

Malnutrition is found everywhere in the world. (Courtesy of United Nations International Children's Fund)

famous nutritionist of the past, Dr. Russell H. Chittenden, who in 1907 wrote in his book, *The Nutrition of Man*: "These three main functions constitute the purpose of nutrition. . . . Development, growth, and vital activity all depend upon food in proper amounts and proper quality."

Malnutrition leads to disease, either acute or subacute, which can only be diagnosed by medical examination. In the subacute stages of malnourishment, individuals may only be approaching an illness. As is so often seen in the developing countries, an infectious disease such as measles or whooping cough in children or the condition caused by hookworm or other body-invading parasites precipitates the illness in the person who has been gradually weakened by malnutrition. At the same time, malnutrition may determine not only the incidence but also the progress and severity of the disease. It may favor the invasion of the agent of the disease and even favor the development of secondary infections, thus delaying recovery from the disease.

AVERAGE GROUP I REGIONS



Total Calories	2150
Total Proteins	58g
Animal Proteins	9g
Fats	34g

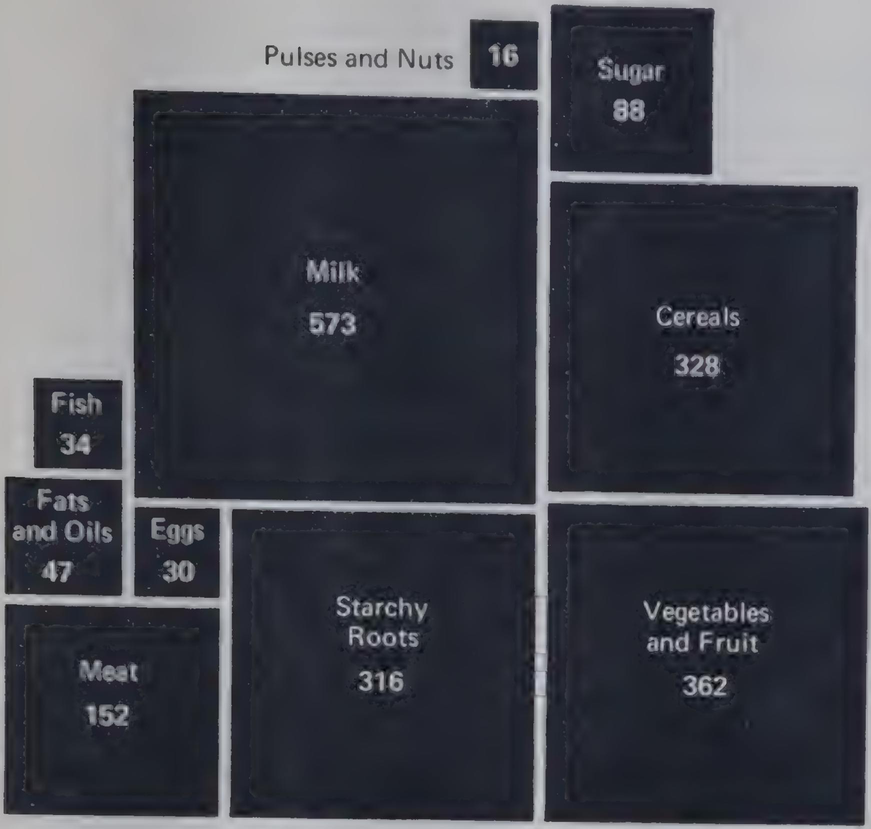
Consumption levels by groups (grams per caput per day at the retail level). Group I includes the Far East, the Near East, Africa, and Latin America excluding Argentina, Uruguay, and Paraguay.

According to Dr. James Hundley:

> *The true roots of malnutrition ramify very deeply into the social and economic fabric of society. In practice, all of the so-called causes are interrelated and interdependent: Agriculture, climate, economics, cultural and social patterns, transportation, communications, education and even religion exercise influences.*

Fundamentally, however, the main root of malnutrition is probably in agriculture. It is usually considered that the permanent correction

AVERAGE GROUP II REGIONS



Total Calories	3060
Total Proteins	90g
Animal Proteins	44g
Fats	106g

Group II consists of Europe, North America, Argentina, Uruguay, Paraguay, and Oceania. (Adapted from: Food and Agriculture Organization, *Six Million To Feed*, World Food Problems No. 4)

of malnutrition lies with those measures necessary to increase agricultural production. Recently it also has been said that the question is one of "matching food with the mouths."

In general, the kinds and amounts of food needed to nourish the human body, even under diverse conditions of climate and environment, are now known. The Food and Agriculture Organization (FAO) of the United Nations has published lists of recommended amounts of certain nutrients for various parts of the world. The problems now are to make food available where it is needed and to teach people to eat it. For instance, in parts of Africa, Central America, and Asia, the diets may be fairly adequate in calories but sadly lacking in such needed nutrients as protein.

NUTRITIONAL PROBLEMS

Studies have shown that the greater nutritional problems in the world today are:

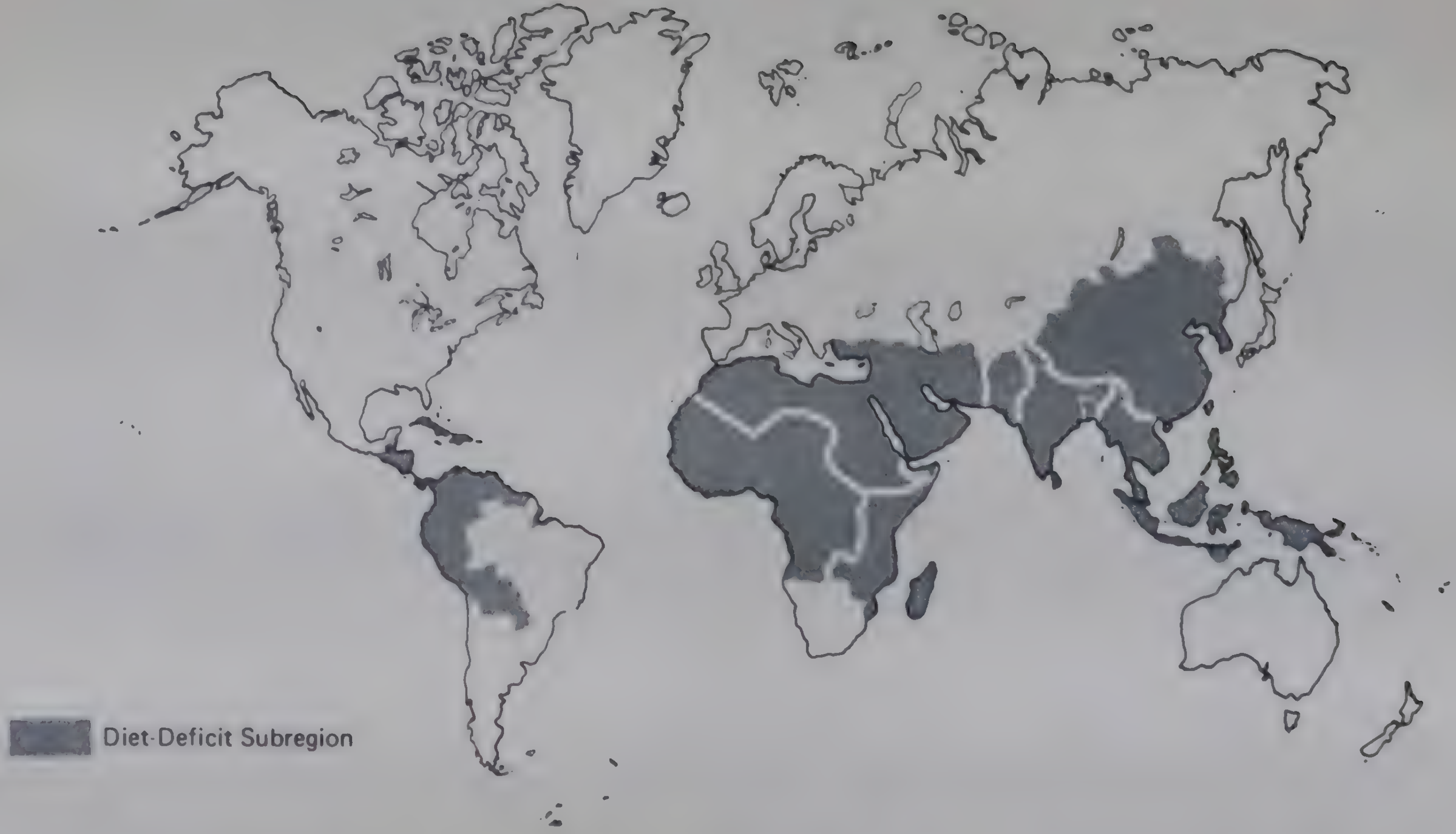
1. General undernutrition where people simply do not have enough to eat.
2. Protein-calorie malnutrition where both the quantity and quality are not adequate, especially during growth.
3. Anemia, which results from an inadequate intake of good protein, iron, or certain vitamins. Growth increases the need for these nutrients.
4. Blindness, and eye conditions leading to it, due to a lack of vitamin A.
5. Skin conditions due to a riboflavin deficiency.

Other conditions such as beriberi, pellagra, goiter, scurvy, and rickets in a severe form are found in certain regions, but on a global basis they are known to be less damaging to the general health of the affected individuals.

Malnutrition is especially prevalent where the diet is largely composed of one of these five calorie-yielding staples of the world's food: rice, wheat, maize, cassava, or millet. It is now recognized that malnutrition in the preschool-age child is a serious deterrent to progress in developing countries; it impairs growth and the later capacity of adults to produce food and create a satisfactory *milieu* for good health. The maimed victims of malnutrition endured in early life lack the vigor and enterprise to raise themselves above the level of their parents.

It is obviously impossible to describe in detail all the diseases of malnutrition. We would like, however, to give a few facts about several of these conditions:

1. *Marasmus* is partial starvation or a gross, chronic calorie deficiency. This is seen especially in children where atrophy of muscles and a shriveled "old man" face are characteristic. In a 1963 report by UNICEF, it is said that physicians in the tropics and semitropics are "too familiar with the wasted limbs, emaciated body and features of the marasamic child."
2. *Protein-calorie malnutrition* is described and discussed in depth in the section on kwashiorkor later in this chapter.


▨ Diet-Deficit Subregion

Diet-deficit subregions, 1970. (Adapted from: Economic Research Service, U.S. Department of Agriculture.)

TABLE 1. INTENSITY OF SPECIFIC NUTRITIONAL DEFICIENCIES IN SELECTED COUNTRIES*

	Nutrient Deficiency																	
							B Complex Vitamins											
	Protein* Malnutrition		Vitamin A		Goiter		Thiamine		Riboflavin		Niacin		Anemia (Iron)		Vitamin C		Calcium	
	C†	A†	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Brazil (N.E.)	I	III	I	II	IV	III	III	II	I	II	—	—	I	II	IV	IV	III	III
Bolivia	I	III	I	II	IV	III	—	—	I	II	—	—	I	II	—	—	III	III
Central America	I	II	I	V	I	II	—	—	I	II	—	—	I	II	—	—	III	III
Chile	I	II	I	II	IV	IV	—	—	I	III	III	III	I	II	I	III	V	V
Colombia	I	II	I	II	I	II‡	I	II	I	II	III	III	I	II	III	III	III	III
Ecuador	I	—	I	II	I	II	IV	IV	III	III	III	IV	I	II	—	—	I	II
Ethiopia	I	III	III	III	IV	III	—	—	—	—	—	—	—	III	I	II	IV	IV
India	I	II	I	II	III	III	IV	IV	V	V	IV	IV	I	II	V	V	III	III
Jordan	I	IV	I	II	IV	II	II	III	I	II	—	—	I	II	—	IV	III	III
Korea	I	III	I	II	—	—	III	III	I	II	—	—	I	II	—	—	—	—
Malaysia	III	IV	I	III	IV	IV	I	II	I	II	—	—	I	II	—	—	IV	IV
Mexico	I	II	—	—	—	—	—	—	—	—	—	—	—	—	—	—	V	V
Nigeria	I	II	I	II	I	V	—	—	—	—	—	—	I	II	—	—	V	V
Pakistan	I	II	I	II	III	III	IV	III	I	II	—	—	I	II	III	II	III	III
Peru	I	II	I	II	I	II	III	III	I	II	III	III	I	II	IV	IV	III	III
Poland	V	V	V	V	—	—	—	—	—	—	—	—	—	—	—	—	—	—
UAR	V	V	V	V	IV	IV	—	—	—	—	—	—	—	—	—	—	—	—
Venezuela	III	—	III	II	I	II	I	II	I	II	—	—	III	II	—	—	—	—
Vietnam	I	—	I	II	IV	IV	I	II	I	II	—	—	I	II	—	III	—	—
Thailand	IV	—	I	III	I	I	I	II	I	II	—	—	—	—	III	—	—	—

From: A. *Schaefer.* Observations from Exploring Needs in National Nutrition Programs. Amer. J. Public Health **56**: *1091, 1966. Copyright 1966 by American Public Health Assoc., Inc.*

** These date are based on nutrition surveys.*

† C = children; A = adults.

‡ Now enriching salt with iodine.

I High priority—prevalence in children, 20 percent or more affected.

II High priority—prevalence in the entire population, 20 percent or more affected.

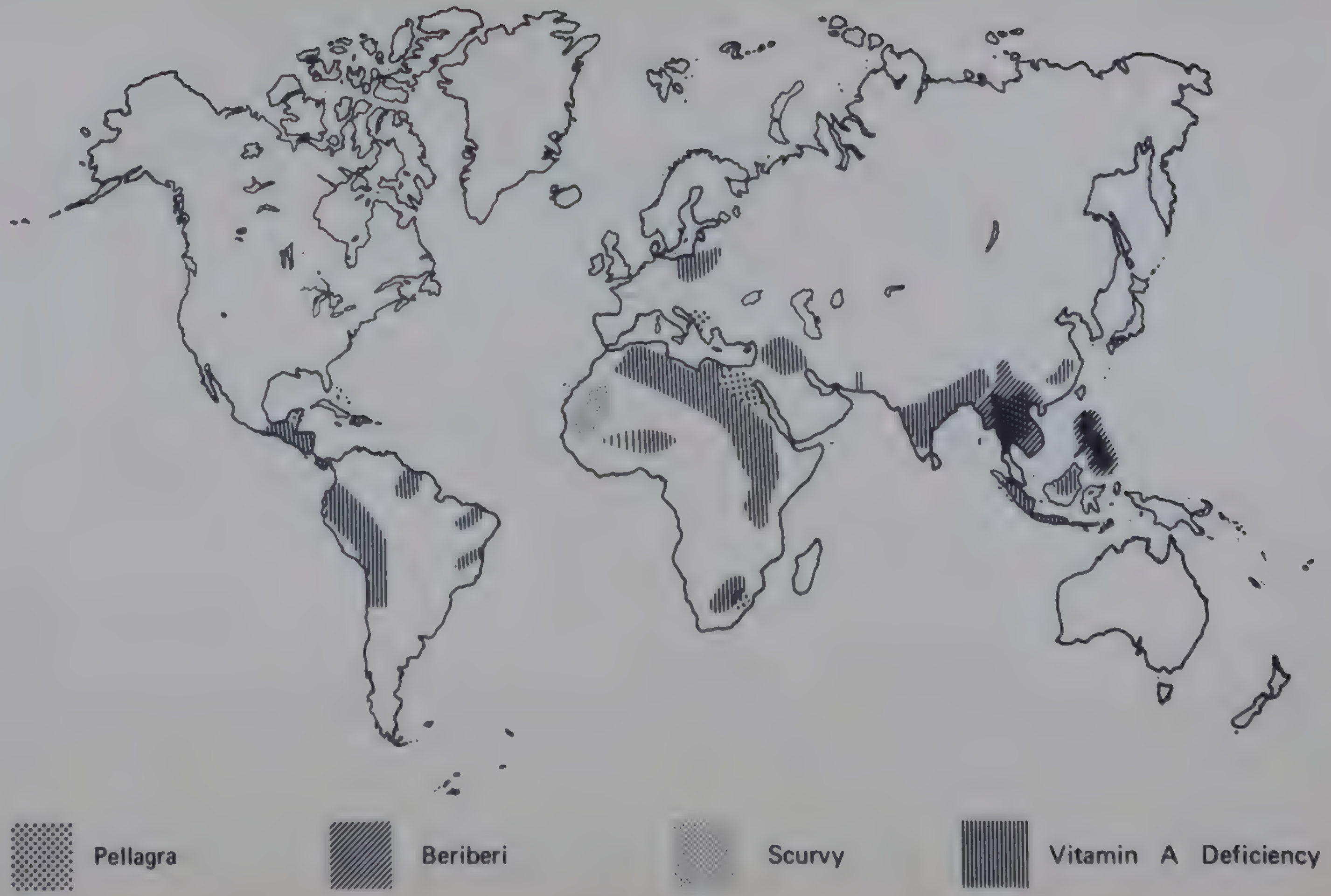
III Prevalence 10 percent.

IV Problem in isolated population groups.

V Deficiency known to exist—prevalence undetermined.

3. *Beriberi* is also dealt with in detail in the latter part of this chapter.
4. *Endemic goiter* is discussed in detail later.
5. *Anemia* is currently a global problem among malnourished individuals, especially pregnant and lactating women and growing infants and children. In these individuals the demands for the formation of hemoglobin, the iron-containing component of the blood, are greatest. The maintenance of an optimum blood supply depends on the capacity of the body to generate new cells with sufficient amounts of hemoglobin so that the blood can perform its oxygen-carrying function. Enough iron and high-grade proteins are often not found in poverty-restricted diets to satisfy the needs for this building of hemoglobin. In another type of anemia, vitamin C and one of the B vitamins (folacin) are the substances lacking in the diet.
6. *Xerophthalmia* is a deficiency disease which, in its most severe form, involves a drying of the membranes of the eye and other changes that cause destruction of the eye and ultimately blindness. This disease is caused by a lack of vitamin A; young children are most frequently affected, although the disease may be seen in all ages. Some cases are found in Latin America and the Middle East, but by far the greatest incidence occurs in Ceylon, Burma, South India, Malaya, and above all in Indonesia. Young children who have only occasional small pieces of fruit or green vegetable with a diet made up largely of a starchy food fall easy prey to xerophthalmia. In parts of the world where red palm oil, which is high in vitamin A, is produced and consumed, the condition is rarely seen. Night blindness and possibly decreased resistance to infection (though the latter is not well proven) are also results of a diet low in vitamin A.

   Xerophthalmia is now considered one of the serious health problems of the world. All skim milk sent from the United States to countries where the need is great is now fortified with vitamin A as well as vitamin D. The mortality rate of malnourished children with this vitamin A deficiency is very high.
7. *Scurvy* is mostly seen in drought and famine areas of the arid countries of the Near East. However, some cases were reported in recent years in Canada and the United States, mostly due here to ignorance and most frequently seen in the lonely old person who lives alone in the slums of industrial areas. Scurvy occurs when there is a low intake of vitamin C. This vitamin is known to be necessary for the formation of collagen, the cementing sub-


Pellagra
Beriberi
Scurvy
Vitamin A Deficiency

Geographical distribution of vitamin deficiencies (general impression). (Adapted from: World Health Organization, *WHO Activities in Nutrition 1948–1964*, p. 27, 1965.)

stance of the cell walls. Vitamin C is also needed for the maintenance of healthy gums and for the functioning of some glands.

Growth causes greater need for vitamin C. Growing infants and children and pregnant and lactating mothers therefore show deficiencies most readily.

8. *Rickets*, seen in North America largely in the 1920's and 1930's, is a disease of infants and young children whose bones are growing rapidly. This disease is caused primarily by a lack of vitamin D, needed for the deposition of calcium in the bones. Vitamin D is found naturally in small amounts in only a few foods such as eggs, cream, and butter and in larger amounts in certain fish. Mostly, however, children do not receive enough vitamin D in foods unless they drink vitamin D-fortified milk as they now do in many parts of the United States. The pro-vitamin of vitamin D occurs in or on the skin and is converted into active vitamin D by the action of sunlight on the skin. Rickets is most severe in children whose diets contain little calcium. Except for the bones of fish and of poultry which are eaten in some parts of the world, milk is the chief food source of calcium. Rickets is found where there is little sunlight or where young infants and children are kept indoors as sometimes occurs even in sunny, tropical climates because of "purdah" or the social value of a pale skin. Rickets is said to occur in Ibadan, Nigeria, because mothers cover their children to shield them from the sun.

   A survey in the United States, done by the Academy of Pediatrics about ten years ago, revealed a surprisingly high incidence of rickets. A recent survey in Seattle, Washington, on the seven-day intake of vitamin D of 150 children, ages birth through seventeen years, showed a great variation in the amount of the vitamin ingested. In this city almost all milk except dry nonfat milk is enriched with this vitamin; some other foods are similarly enriched. A number of the children in this study, however, had several of these sources irregularly.

   Vigilance concerning the level of intake is evidently called for, because it is possible for a child to consume too much as well as too little vitamin D.

9. *Pellagra* is essentially a disease of maize-eating people who are too poor to afford other foods such as meat, fish, or other whole grain cereals which carry the needed vitamin, niacin. Large numbers of cases of this disease occurred early in this century in the southern United States; it still is a problem in parts of Africa, India, Egypt, Portugal, Latin America, and Yugoslavia.

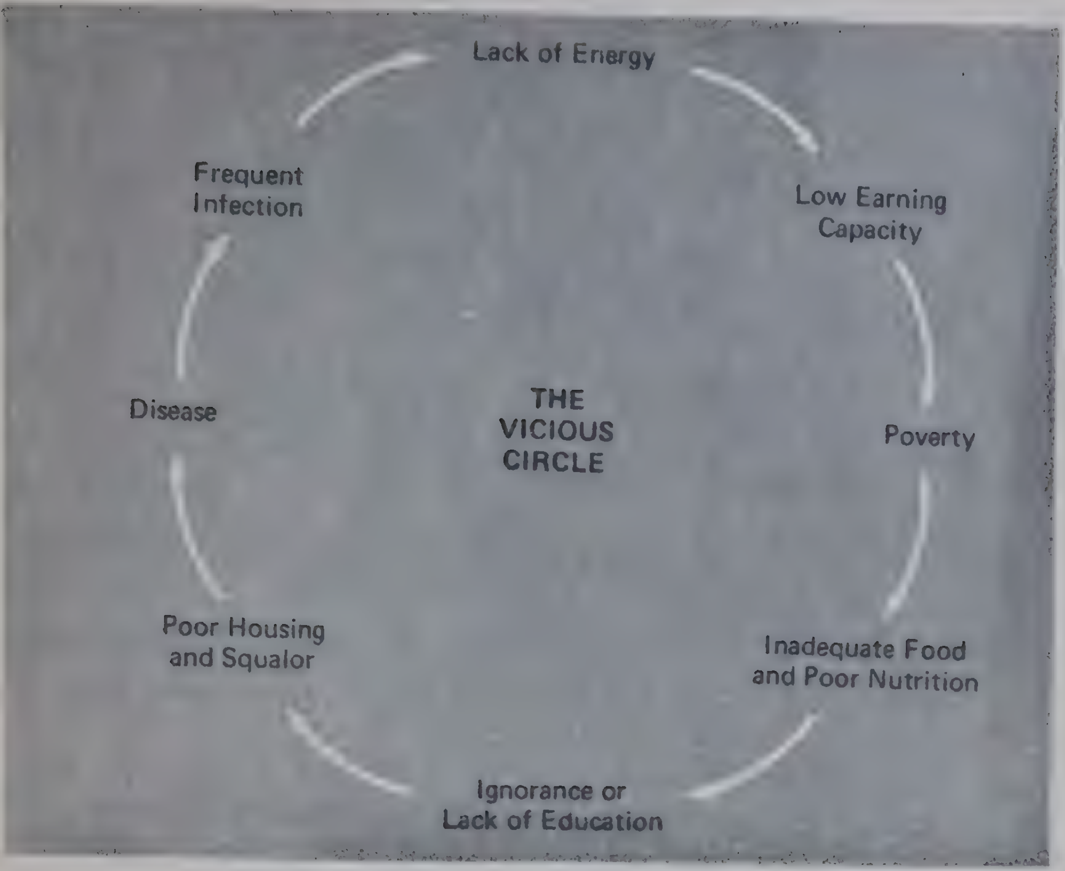
10. *Ariboflavinosis* is, as its name indicates, caused by the lack of riboflavin, one of the vitamins of the B complex. Tissue changes occur in the tongue, mucous membranes of the lips and mouth, and the skin around the base of the nose. Improvement in the diet causes a healing of these lesions.

    Although this disease is still referred to as a problem, there are fewer data available on its frequency and geography than for many other conditions. The association of this condition with a lack of vitamin A probably increases its importance.
11. *Obesity* in the affluent countries is currently one of the greatest problems in nutrition. It is said that ten to fifteen percent of the adolescent population can be called obese, a higher incidence being found in girls. The relationship of this condition to heart disease and the degenerative diseases has directed much attention and research to it. Obesity is now known to arise from a complex interrelationship of psychological, physiological, environmental, and genetic factors as well as an excess of calories.
12. *Dental caries* is often listed as a disease of nutrition because its incidence can be reduced by fifty percent with adequate water fluoridation, limited use of sticky, highly sweet foods, and thorough cleaning of the teeth after the ingestion of food.

    Statistics on the incidence of this disease have caused it to be called the chief disease of nutrition in North America. Its incidence in other parts of the world is variable, being highest where the intake of refined carbohydrates is greatest. The fluorine content of the water supply is another factor in the incidence of dental caries.

Illness, with all of its attendant drains on the individual, the family, the community, and even the economy of a nation, would alone justify the world's attention to the problem of malnutrition. The high death rate in most developing countries, though decreasing, still is strikingly illustrated by the average length of life. It was said a few years ago that an infant in some Far Eastern countries had then as much chance to live to be five years of age as an infant born in the United States had to live to be sixty-five years of age. The exact ages in this comparison may vary as situations change, but the relative chances are still strikingly different.

As mentioned previously, inability to work and lack of energy are seen in malnourished people. Although these people often are called lazy, the wonder is not that they do not do more work on their low-food intake but that they manage to do so much.


Lack of Energy
Low Earning Capacity
Poverty
Inadequate Food and Poor Nutrition
Ignorance or Lack of Education
Poor Housing and Squalor
Disease
Frequent Infection
THE VICIOUS CIRCLE

The vicious circle illustrates the close relationship between health, economics, and social progress—how poverty engenders disease which in turn engenders more poverty. (Adapted from: *World Health*, p. 11, Sept.-Oct. 1961.)

Without fail, growth is depressed when the young body is ill fed. Often this is the first sign of inadequate food. Formerly we paid little attention to slower physical growth and development in children in some countries; we even accepted them as if it were an innate genetic factor that a man's wrist bones were the size of that of a ten-year-old boy in the United States. Recent studies in post-war Japan and in many other parts of the world have shown that adequate food during growth can make a difference in the adult size of peoples formerly thought to be predestined to be small in stature.

Within the past several decades, severe loss of weight has been seen by most people, either firsthand or in the newspaper pictures in prisoner-of-war camps. Almost no one presently can be unaware of it as a factor in nutrition. When horror pictures of this condition were shown in the author's class during the lecture on hunger, the college students were curious, interested, and not highly disturbed.

Within recent years, as discussed in the section on kwashiorkor, scientific evidence has increasingly shown that, in severe malnutrition the potential for intellectual development can be permanently damaged in human beings. This, as has been shown conclusively in animals, is probably most severe when the malnutrition occurs in the very young infant under six months of age. The logic of impairment of growth of the brain when tissue in that organ is being formed at a rapid rate is certainly clear, and now scientific evidence is beginning to indicate that this hypothesis is probably true. It must be remembered that, by the end of the second year of life, the child's brain has attained seventy to eighty percent of its adult size and weight. A lessening of intellectual-development potential, possibly causing in severe cases actual mental retardation, places an urgency on prevention of malnutrition.

Social behavior also has been observed to be changed in some diseases of malnutrition; this is almost universally seen with kwashiorkor as discussed on page 220. In milder forms of undernutrition, it is thought that low morale among the group may be one result. This leads to the vicious cycle so well illustrated on page 195.

It is difficult to describe the needs for a solution of the problem of malnutrition more succinctly and adequately than is done in the publication, "Malnutrition and Disease," which was published by WHO in 1963. It states:

> *The solution of the problem of the hungry must take into account complex factors affecting almost every aspect of the life of man—climatic, economic, social and educational, religious and cultural. The solution will depend upon achieving cooperation between governments, national and international agencies, and workers in many scientific fields with the active participation not only of people in the developed countries but also the sufferers from malnutrition themselves.*

BERIBERI

Beriberi today is only a name to many Americans; but to those who live in the rice-eating countries of the world, it can be a major cause of death and disability. This disease is discussed here because it is still a serious problem, as it has been through the centuries, in many countries of the Orient. Also, it is an example of a disease of malnutrition. Beriberi is caused by a deficiency of one of the vitamins, thiamine, but is also complicated by lack of other nutrients when white rice is practically the only food.

In Chinese writings of the third, seventh, and eighth centuries, there are references to this disease which was called "kak-ke." The first European description of the disease was in a book written by a Dutch physician, Jacobus Bontius (1592–1631), and published in 1642. Bontius was physician with the East India Company and was sent to Batavia in 1627. He must have been a conscientious doctor, because when he realized how little he knew about tropical disease, he started to make a careful record of all he saw. An English translation of this book appeared in 1769. Bontius wrote: "The inhabitants of the East Indies are much afflicted with a troublesome disorder which they call the Beriberii." He described the disease as producing a loss of sensation in the feet and hands, a peculiar way of walking, and the whole body sometimes trembled.

Beriberi, although well understood now, still occurs in many parts of the world. The cause is known, the cure and way to prevent it also are known. But with this disease we have an interesting example of food habits and customs having a stronger influence in the lives of people than scientific knowledge.

What Beriberi Is

Beriberi is a disease which affects the nervous tissues of the body. Four main types of the disease have been described. They are:

1. Wet beriberi in which there is edema or swelling of the legs, hands, and abdomen due to accumulation of fluid in the tissues.
2. Dry beriberi with neuritis, wasting and atrophy of the muscles, especially of the legs, and difficulty in walking.
3. Acute cardiac beriberi with sudden onset of nausea and vomiting, enlargement of the heart, and increased heart rate.
4. Rudimentary beriberi with mild symptoms of weakness in the legs, some swelling, abdominal pain and heart palpitation. This form may exist for years or may suddenly develop into one of the other types and quickly become fatal.

The characteristic symptoms of beriberi are a tendency to edema, pain and loss of use of the limbs, and heart failure. Every combination of these symptoms may be found when examining a large number of cases of beriberi. We are not concerned here with clinical or technical details, but rather with the evidence that beriberi is a dietary disease, how this was discovered, and what the problems are today. You may enjoy the challenge of following the major studies reported here and determining for yourself how soon you can reason conclusively from the evidence what is the specific cause of beriberi.

How Beriberi was Identified as a Dietary Disease

From 1859, reports about the occurrence of beriberi in the Dutch navy appeared in Dutch medical journals. The suggestion was made that it was in some way caused by poor food, but nothing was done about this.

In Japan, beriberi or kakké was a serious problem, especially in the navy where there were several hundred cases per year and an average of 8.39 deaths per thousand men. In 1883 Kanehiro Takaki (1849–1920), a Japanese medical officer, entered the navy in 1872; during three years of service, he saw hundreds of cases of beriberi, and so determined to learn everything that he could about the disease. Takaki went to England for medical study; when he returned to Japan, he was appointed director of the Tokyo Naval Hospital and later became director of the Naval Medical Bureau. Takaki carefully and systematically studied the disease of beriberi, its occurrence and location. He found that it was most frequent at the end of spring and summer though some cases occurred in winter. He observed that soldiers, sailors, policemen, students, and shop boys suffered most. It was more common in large towns but was also present in small ones. And it occurred without any relation to the kind of living quarters or clothing. Takaki then turned his attention to the food of these people and especially those in the navy. From calculations of the fat, carbohydrate, and protein in the rations, he saw that the carbohydrate, rice, in the ration was very high and that there were not enough protein foods to make up for the body loss of nitrogen. He also saw that the higher the ratio of carbohydrate to protein in the diet, the higher the incidence of beriberi.

Takaki proposed some dietary changes to the navy, but his ideas were not accepted; he therefore planned an experiment which would demonstrate whether his diet theory was right. The ability and clear thinking of Takaki are beautifully illustrated in the story of his experiment which was carefully planned and controlled. Two naval training ships were sent on the same long voyage across the equator and into the South Pacific so that any effect of different climate would be observed. The one difference was in the kind of ration used on the ships. The training ship *Riujo* had 276 men and officers and sailed from Shinagawa, Japan, to Wellington, New Zealand, then to ports in Chile and Peru, and then to Honolulu. It returned to Japan after a voyage of

272 days. The customary naval ration was used on the *Riujo*, and there were 160 cases of beriberi and twenty-five deaths during the voyage.

The second ship, *Tsukuba*, followed the same course; all conditions were as nearly similar as possible except the ration was improved by increasing the amounts of meat, fish, and vegetables, adding some condensed milk, and decreasing the amount of rice. The voyage lasted 287 days and there were no deaths. But there were ten cases of beriberi in men who had not eaten all parts of the new ration, particularly the milk and meat.

This clear demonstration of the value of improved diet in eliminating beriberi in the Japanese navy did not have much influence at the time it was published (1885–1888) because it was in Japanese journals and so not available to European workers. Also, this was the period of preoccupation with the bacterial origin of disease. Beriberi was believed to be due to an infection; then, when attention focused on food and especially rice in the diet, it was thought that some toxin in rice was the cause. With difficulty the final solution to the problem was obtained chiefly through investigators in three different geographical areas—the Dutch East Indies, Malaya, and the Philippines.

Before we follow up the work in these countries, we must stop a moment and look at rice. Rice is the cereal grain which is the main food for more than half the world's population; varieties of rice are numerous; and terms to describe different forms of rice are sometimes confusing. The following descriptions give a general idea of terms and should help you to understand the relation of rice to the story of beriberi.

1. Paddy or rough rice—this is rice as it comes from the fields which are also called paddies; it is rice in the hulls.
2. Brown rice—the hulls have been removed but the outer coats of the grain and the germ are left. This form is very susceptible to attack by weevils and becomes rancid.
3. Polished or white rice—the germ and outer coats have been removed and the white starchy grain remains.
4. Parboiled or cured rice—this form is used mainly in India or in countries where there are large colonies of Indians. Rice in the hull is soaked, then steamed, and then dried in the sun; in this process the vitamins are drawn into the center of the grain and are not lost in milling.
5. Converted rice—this is rice commercially processed in the United States using the same principle as in parboiling.

6. Enriched rice—in enriched rice a premix is added to ordinary polished rice in definite proportions. The premix consists of specially treated rice grains that are impregnated with thiamine and other nutrients.

And now back to our main story and the work in the Dutch East Indies.

Dutch East Indies

A key figure in the story of beriberi is Christian Eijkman (1858–1930) who, upon completing his medical training at the University of Amsterdam, was sent to the Dutch East Indies as an army surgeon. After two years he returned to Holland to recover from malaria and became interested in the new science of bacteriology; he then studied under Robert Koch in Berlin. In 1886 Eijkman was appointed by the Dutch government as member of a commission to go to the East Indies and find the cause of beriberi which was responsible for so many deaths there. The commission thought beriberi was an infection; Eijkman remained in Batavia as director of the new research laboratory of bacteriology and pathology. For some reason, not known now, domestic fowls were kept in the laboratory and were fed the waste food, mainly white rice, from the military hospital wards. The birds quickly developed polyneuritis gallarium, a disease similar to beriberi in man. This was reported in Dutch medical journals (1890) but apparently was not read by other investigators.

One story tells that an economy-minded administrator cut off Eijkman's supply of cooked white rice for his birds, so he had to buy cheap brown rice for them. To his surprise the polyneuritis was cured. Eijkman was a bacteriologist and thought that there was a poison in the white rice and that the outer coatings of rice were an antidote. However, to Eijkman must go the credit for the experimental approach to study of dietary diseases by his being able to produce and cure polyneuritis in fowls and show that this was the same disease as human beriberi. Ill health caused Eijkman to return home, but his work was carried on by Gerrit Grijns (1865–1944) who continued the experiments with fowls. When Grijns fed the birds various native beans or brown rice, they maintained health; if polished rice from various countries was used, the birds died; addition of olive oil or mineral elements and salt mixtures to their diet did not help. Meat that was extracted with water and then dried gave no protection, nor did potato starch and milk sugar. Thus it was shown that no dietary factor then known could prevent polyneuritis, and Grijns concluded that some unknown dietary substance was necessary. This study was published in 1901, but few were ready to accept or apply these findings. And being written in Dutch, as was the case with Eijkman's work, the report could be read by few.

Malaya

W. L. Braddon, a British physician who had worked for many years in Malaya, observed differences in occurrence of beriberi among the racial groups living in Malasia. The Malays used home-pounded (unpolished) rice and rarely had beriberi. The Tamils, who came from southeastern India, used parboiled rice and did not have beriberi. The Chinese used imported white rice and had a high incidence of beriberi. Europeans used little rice of any kind and did not have beriberi. The focus was on rice, but Braddon believed it was a poison associated with white rice that caused the disease.

W. Fletcher followed with studies on rice (1906–1907). Patients in an asylum were divided into two groups; one group ate polished white rice and the other group parboiled rice; the rest of the ration was the same for each. Over a period of six months, there were fifty-three cases of beriberi with white rice and none with parboiled rice. Fletcher theorized that there were three possible explanations: (1) there was a poison in white rice, (2) the ration was deficient in protein, and (3) white rice was so low in nutritive value that the patients were susceptible to attack by some organism. This was an excellent and convicing experiment.

Two other British physicians working near Singapore went a step further. H. Fraser and A. T. Stanton had the opportunity to study three hundred laborers on road construction in two different camps in virgin jungle. The men were in new living quarters with good drainage and, on examination, all were in good health. They all were given a diet of rice, dried salt fish, onions, potatoes, coconut and oil, tea, and salt. The kind of rice, however, was different in the two camps. One camp had white rice, the other parboiled rice; those men receiving white rice developed beriberi, but those on parboiled rice did not.

Fraser and Stanton made extracts of rice and could find no traces of any toxic substance. They treated the parboiled rice to long extraction with hot alcohol; after this treatment the parboiled rice no longer protected fowls from beriberi. But if they added the alcohol extract itself to white rice, the birds did not get beriberi. In 1910 they reported that "our researches have conclusively shown that beriberi can be prevented by the use of unpolished rice and as surely produced by the use of highly polished rice." Here was the answer at last, or at least the first part of it. A little over a year later Casimir Funk introduced the term *vitamine,* and many workers became active in this new field of investigation (see Chapter 1).

Philippines

In this same period, beriberi was being studied in the Philippines. The Philippine Scouts (Filipino soldiers with American officers) had many hospital cases and a high death rate from beriberi (1902); when eventually (1910) their diet was changed to less rice and the rice was the undermilled form, beriberi rapidly disappeared. Infantile beriberi was also a serious problem. Feeding experiments in prisons, carried on quite independently but in similar fashion to those in Malaya, added further evidence to the dietary origin of the disease. But the work was to be carried much further in Manila.

Edward B. Vedder of the United States Army Medical Corps served in various capacities in the Philippines from 1904 to 1913 and was concerned with the beriberi problem. He studied everything written on the subject and found it so confusing that he said it was difficult "to sift the wheat from the chaff, or the rice from the rice polishings!" His book, *Beriberi* (1913), is a classic on the subject. When R. R. Williams (1886–1955), a young chemist, received his master's degree from the University of Chicago, his first professional appointment (1908) was in the Philippines. There he soon became associated with Vedder who started him on the search for and isolation of the antiberiberi vitamin. This search lasted twenty-six years until Williams found a way to prepare thiamine and determined its chemical structure and then its synthesis. His whole life was devoted to efforts to eliminate beriberi throughout the world. The discovery of the specific beriberi factor, first called vitamin B_1, then named thiamine, is a story which belongs to chemistry. Vedder, Jansen of Holland, and Williams were outstanding figures in this story.

Because of Williams' success in synthesizing thiamine, it can now be prepared cheaply. This led in 1941 to what has been called the enrichment program. During the years of World War II, the millers and bakers in America worked together with nutrition scientists on a plan whereby thiamine, iron, and niacin (and later riboflavin) could be added to flour, bread, and baked goods; the United States government made it mandatory during wartime that these products should be enriched. This was a measure to protect the health of all people against deficiencies in the diet because of wartime food shortages. Enrichment proved so beneficial that a number of states passed their own enrichment laws and continued to require enrichment of bread, flour, and cornmeal. And in a few states rice is enriched with thiamine because a practical way was found for adding thiamine to white rice.

If enrichment was beneficial to the population in the United States, how much more beneficial it would be in those countries where beriberi was endemic. Williams believed in this solution and worked hard for it. One of the more recent exciting stories of a human nutrition experiment is one that Williams helped to plan and initiate in the Philippines. It began in 1947; the Bataan peninsula was chosen because it is somewhat isolated with only one good road running the length of the peninsula so distribution of rice could be controlled. A survey was made of the incidence of beriberi, and cases equivalent to 12.7 percent of the population were clearly identified. Analyses of Bataan foods were made to determine their thiamine content, and clinical and biochemical measurements were made on a selected group of the people. The peninsula was divided into two areas. Beginning in 1948, the people in area A on the east coast were supplied with enriched rice, while those in the rest of the province, area B, received only white rice. When the groups were surveyed again a year later, there had been a marked drop in incidence of beriberi in the area which received the enriched rice and a slight increase in beriberi in the white rice area. For such large-scale experiments on people, it is difficult to control all factors; nevertheless, this experiment did show that it is practical and effective to increase the thiamine intake by use of enriched rice.

Beriberi has not been confined to the peoples of the world who eat rice. It has occurred in Labrador and Newfoundland and, in isolated cases, in institutions in the United States when white bread and white flour have been used as the staples of the diet.

The current world situation regarding beriberi is best described by quoting from a report of the World Health Organization (1958):

> *. . . beriberi remains a serious public health problem in a number of rice-eating countries in South and East Asia, particularly in Burma, Thailand, and Viet Nam; and the disease is causing a large number of deaths in breast-fed infants between the first and sixth months of life. Surveys in Burma and Thailand by WHO officers support these conclusions. There are indications that the prevalence of beriberi is increasing, in association with the spread of small rice mills, in a number of rural rice-producing areas in East Asia. . . .*
>
> *The causes of beriberi are fully established and methods of preventing it have been known for more than forty years. . . . There is ample evidence that beriberi can be eradicated.*

For example, while it was common in Japan in the early decades of the century, it is now a rare disease there as a result of changes in the national diet and preventive measures taken by the authorities.

Thiamine and Food

Thiamine functions in the body as part of certain enzyme systems, particularly in those which have to do with the utilization of carbohydrates. Therefore, the higher the intake of foods that are high in starch, such as polished rice or unenriched white flour, the greater is the need for thiamine; and the higher the calorie intake, the larger is the amount of thiamine that must be supplied in the diet. This is why men or any one who is active or doing physical work need more thiamine or get beriberi if there is a dietary deficiency. Also, women under stress of pregnancy and lactation have increased need for thiamine. The nursing mother who lives on white rice produces milk which is almost devoid of thiamine, so her infant gets infantile beriberi; this is a high cause of infant mortality in some Asian countries.

Thiamine is present in many foods but usually in small amounts, and a few foods such as the fats and oils and refined sugars are devoid of thiamine. The cereal grains are good sources, but the thiamine is in the germ and outer coatings so that refined cereals such as white rice and white flour have lost their thiamine. Legumes such as various kinds of peas and beans, fresh or dried, and soybeans, lentils, and peanuts are significant sources. The animal foods, meat, fish, milk, and eggs, contain some thiamine; liver is higher in thiamine than muscle meat. And for some unknown reason, pork is a rich source; a liberal serving of pork supplies a day's requirement of thiamine. A variety of foods in the day's meals has many nutritional advantages, not the least of which is protection against a deficiency of thiamine. Enrichment of bread and cereals in the United States is one of the added protections provided in this country.

Thiamine has the chemical qualities of being soluble in water and destroyed by high temperatures and by some chemicals including soda used in the treatment of foods. Since it is water soluble, thiamine may be lost when large amounts of water are used in cooking vegetables or rice and the cooking water is thrown away. This water solubility of thiamine explains why thiamine-containing foods should be eaten daily; this vitamin is not stored in the body—excess amounts are excreted.

Subclinical Thiamine Deficiencies

While beriberi is seen only in certain countries today, we must not lose sight of the fact that beriberi occurs when the diet is grossly lacking in thiamine. What about the people who get some thiamine but not enough? This can occur here or in any country; this condition is referred to as subclinical deficiency, meaning that the dietary lack is not so great as to cause definite illness, but the intake is not enough for good health. The effects of insufficient thiamine are hard to define, but clinical experiments show that low thiamine intakes may lead to loss of appetite, fatigue, irritability, and digestive disturbances (all of which we know may be caused by others factors also). How much of this type of subclinical deficiency exists with regard to thiamine (or for that matter for the other vitamins and other nutrients) in many countries of the world is difficult to estimate; it is part of the problem of widespread malnutrition.

Dietary studies, where records are made of the kinds and amounts of food eaten by individuals or families and then the nutrient content of the diets calculated, indicate that many groups do not receive adequate amounts of thiamine (or of other nutrients) even though there are no obvious symptoms of disease. Such dietary studies are expensive, time consuming, and require trained personnel and, therefore, have not been made for populations in many areas. Biochemical measurements of the blood also provide information on adequacy of thiamine intake, but these are more expensive in equipment and personnel and so have been even more limited than dietary studies.

ENDEMIC GOITER

There are estimated to be 200 million cases of endemic goiter in the world today, according to a World Health Organization (WHO) report in 1960. This disease has been known for hundreds of years, but only in this century has the science of nutrition provided the evidence as to how this disease may be prevented. A century ago a French scientist provided the correct theory about the cause and prevention of endemic goiter, but his contemporaries simply could not believe such a possibility. This has recurred throughout science and man's history—discoveries have been made but not accepted because the ideas have been ahead of their time.

The major cause of endemic goiter is a deficiency of iodine in the diet. This is a simple statement and one well verified by extensive experiments; by analyses of drinking water, soil, and food; and by clinical data. Study of this disease illustrates how much easier it is to understand discoveries when they fit in with the background of science and what we already know, and how difficult it is to accept that which is new when it is different from current beliefs.

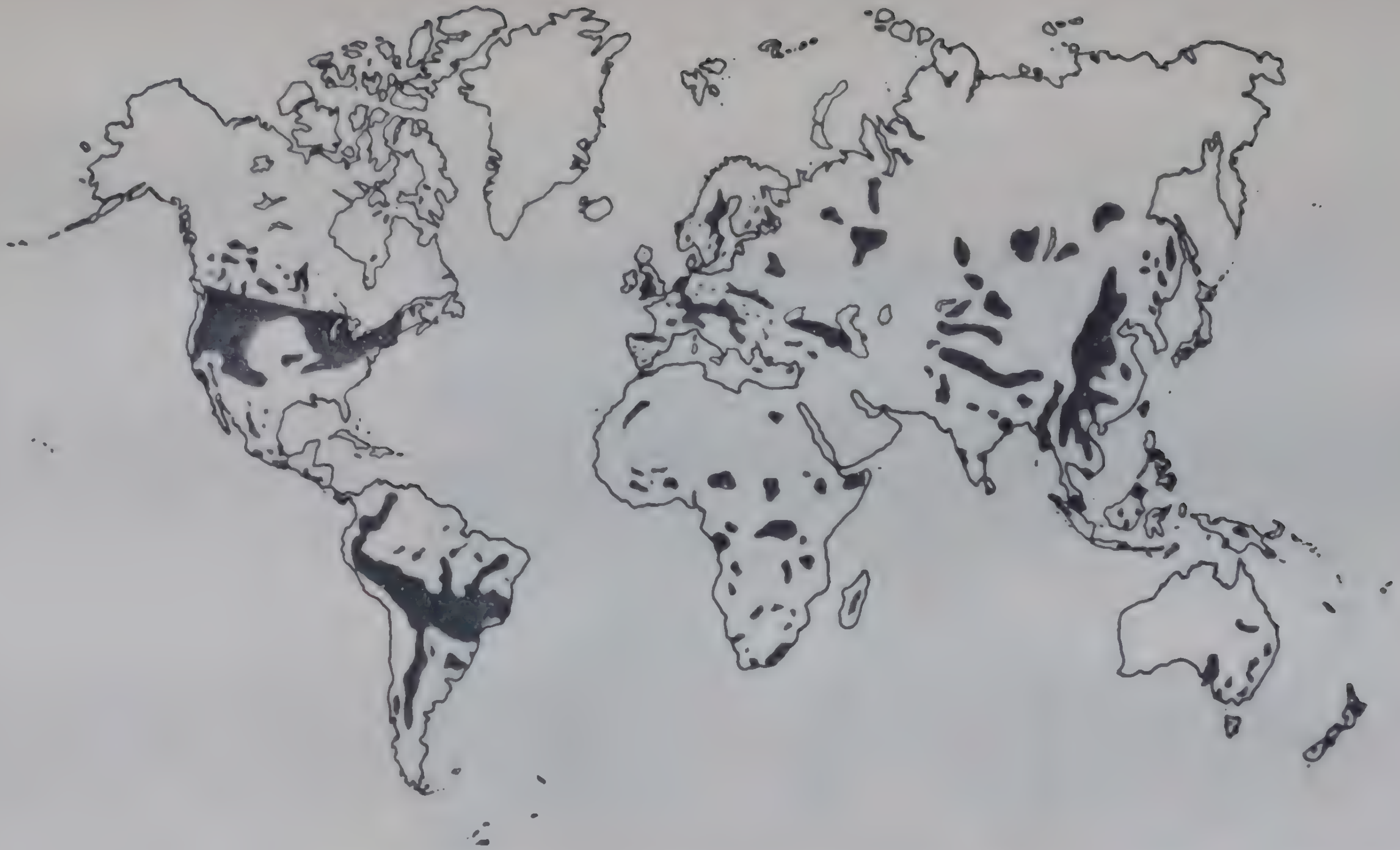
Goiter is no respecter of persons or places (see map). It occurs in some part of almost every region and country of the world, so it is obvious that climate or weather or temperature is not the causative factor. All people whatever their race, color, creed, or socio-economic group are susceptible to this disease. The high incidence of endemic goiter in the United States only fifty years ago led to the experimental studies in the Great Lakes region which demonstrated how this disease could be prevented.

Our story of this disease and how to prevent it involves chemical elements and compounds, some physiological terms, and a gland of the body. Definitions and explanation of these terms will lead to fuller understanding of this deficiency disease.

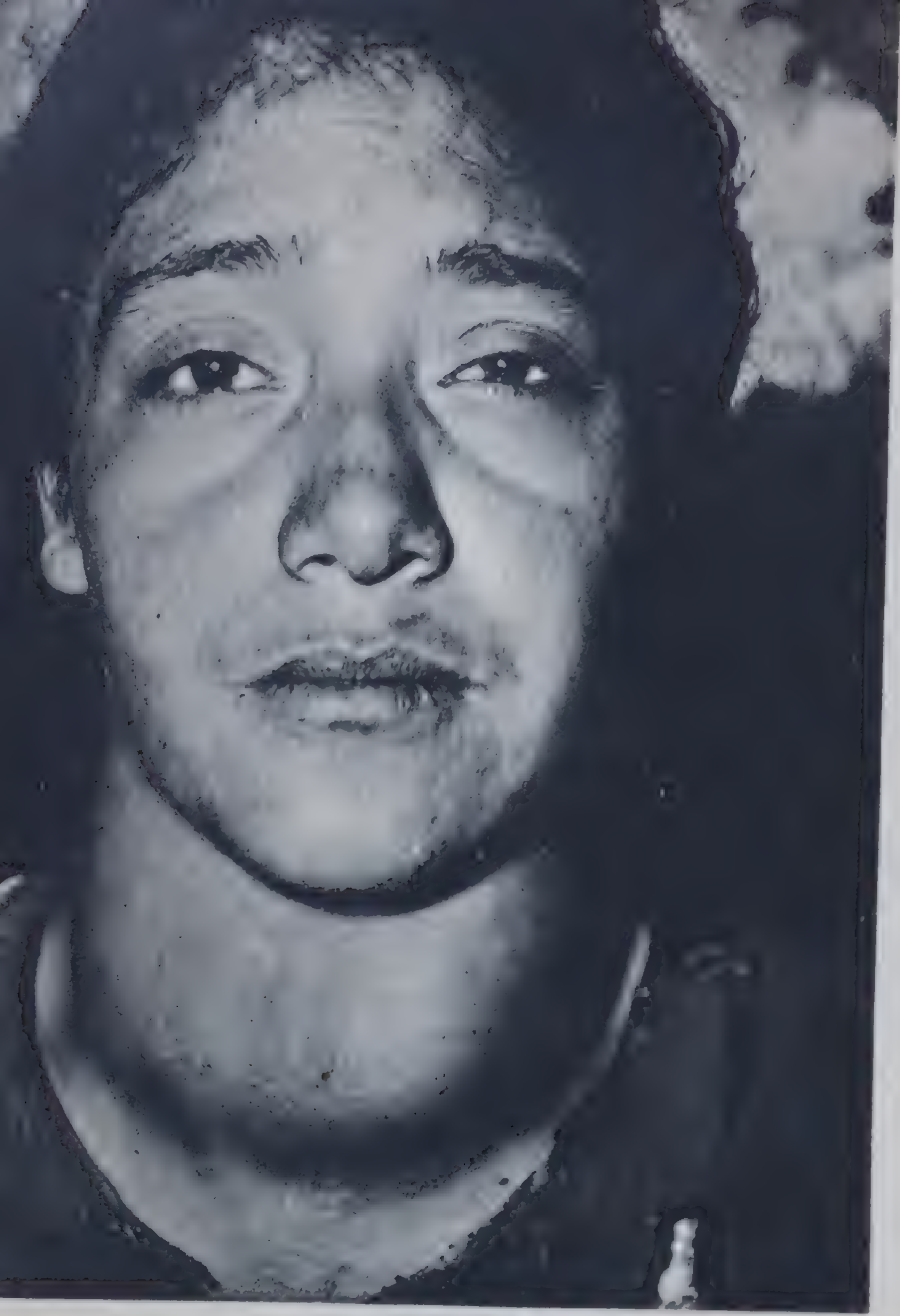
1. *Iodine* is a chemical element first discovered by a French chemist, Bernard Courtois, in 1811 when he was preparing saltpeter for gunpowder for Napoleon's army.
2. *The thyroid*, a ductless gland at the base of the neck, uses iodine to make a hormone needed by the body for its normal processes. The name thyroid was given to this gland by an English physician, Thomas Wharton, in 1646; he was the first to determine the site, size, and weight of the gland.
3. *Thyroxine* is a hormone secreted by the thyroid gland which must be supplied with iodine in order to make this hormone; thyroxine was first prepared by Edward C. Kendall of the Mayo Clinic in 1914.
4. *Endemic goiter*, sometimes called simple goiter, is a condition of enlargement of the thyroid. Endemic means that it occurs in a large number of the people in a particular community or location. There are many other types of goiter and thyroid gland disorders which are different from endemic goiter in their effects and causes.
5. *Goitrogenic factors* are ones which produce goiter; the word goitrogenic comes from the Greek root *genic* which means "giving rise to."

The Discovery of Iodine and the Cause of Goiter

Goiter is believed to have occurred for thousands of years and to have been described by the ancient Chinese, early Hindus, and the Egyptians.



Goiter areas of the world. (Adapted from: World Health Organization, *WHO Activities in Nutrition 1948–1964*, p. 25, 1965.)



About 200 million cases of endemic goiter exist in the world today. (Courtesy of World Health Organization)

Difficulties in language, different meanings of words, and lack of knowledge in early times about the organs of the body leave us uncertain as to exactly how long this disease has been known.

At the beginning of the nineteenth century, biological and medical research had progressed to a stage where more exact and careful studies could be made on goiter. After Courtois discovered iodine (1811), a Swiss physician, Jean Francois Coindet (1820), recommended its use for treatment of goiter. However, the doses used were too large and there were harmful effects, so the use of iodine fell into disrepute. Some thirty years later, a French chemist, Gaspard Adolph Chatin, published results of research where he determined the iodine content of air, water, soil, and plants in many parts of Europe. He found that in Paris, where goiter did not occur, the people had a daily intake of iodine five times as high as the people of Lyons and Turin where there was moderate goiter. In the alpine villages where there was much goiter, the people obtained only one-tenth as much iodine a day as the Parisians had. Chatin concluded that iodine deficiency was the cause of goiter, but his contemporaries rejected this idea.

Little progress was made in understanding the cause of goiter until 1895 when Eugen Baumann, a German chemist, analyzed the thyroid gland and showed that it contained iodine in small amounts. At last scientists had a connection between iodine and goiter. However, since goiter was not a fatal disease, it did not attract as much attention or study as did some of the more serious diseases.

In the United States there were serious problems in the cattle industry in various areas of the country, especially in Michigan and in parts of the West. There were heavy losses of young lambs, calves, and colts; piglets were born hairless and were stillborn or died within a few days. At this time (1907) a young medical research scientist, David Marine, in Cleveland, Ohio, began studies on the thyroid that were to lead to worldwide recognition that deficiency of iodine caused goiter. He first analyzed the thyroids of sheep, cattle, and hogs and found a relationship betwen iodine and the structure of the gland. Then he spent several years, at the request of the Pennsylvania State Fish Commission, investigating the cause of thyroid disease in fish; this disease interfered with the raising of brook trout in the fish hatcheries. He eventually showed that the problem could be prevented by inclusion of iodine in the food of fish.

If iodine prevented goiter in farm animals and in fish, then surely the same must be true for man; but experimental evidence was essential. Dr. Marine began work in 1916 with school girls in Akron, Ohio. He surveyed all the girls from the fifth to the twelfth grades to find the incidence of goiter. There were 4,466 girls examined, and fifty-six percent had enlarged thyroids. With the approval of the local medical society, the school board, and the school superintendent, treatment by iodine (sodium iodide) was begun in 1917 for all girls who elected to have it. Examinations of the thyroid were made twice yearly. At the end of thirty months, Dr. Marine reported:

> *. . . of 2,190 pupils taking 2 gm. sodium iodide twice yearly (given in 0.2 gm. doses daily, for ten consecutive school days each spring and autumn), five have shown enlargement of the thyroid, while of 2,305 pupils not taking the prophylactic 495 have shown enlargement of the thyroid. Of 1,182 pupils with thyroid enlargement at the first examination and who took prophylactic, 773 thyroids have decreased in size, while of 1,084 pupils with thyroid enlargement at the first*

> *examination and who did not take the prophylactic, 145 thyroids have decreased in size. These figures demonstrate in a striking manner both the preventive and therapeutic effects.*

This was the first largescale controlled study on man of a dietary-deficiency disease.

Dr. D. Marine shared his results with Dr. R. Klinger in Zurich, Switzerland, where goiter was very severe in some areas. Dr. Klinger undertook similar treatments of school children and obtained even more striking results in prevention and improvement of goitrous conditions.

Some investigators believe that there is a relationship between goiter and cretinism and the accompanying feeble mindedness and deaf mutism. However, this has not been clearly defined, and more research is needed to clarify this question.

India is one of several countries which have attacked the problem of goiter. A pilot study was made between 1956 and 1962 to see whether iodized salt would be effective in preventing goiter. Two zones were chosen, and about five thousand people in each were examined for incidence of goiter. One zone received iodized salt and the other received ordinary salt for a five-year period. The people were then reexamined. In the zone where iodized salt was used the number of goiter cases was reduced from forty percent to about seventeen percent of the population. In the zone receiving ordinary salt the number of goiter cases remained at the same level it had been. The Indian government followed up this study by arranging to produce iodized salt for the people in several states of India.

Age and Sex Incidence

In areas where goiter is endemic, it may occur in individuals at any age; in highly goitrous areas, babies may be born with goiter. The highest incidence is in girls twelve to eighteen years of age and boys nine to thirteen years old. Pubertal changes appear to increase the need by the thyroid gland for iodine. Females are more susceptible to goiter than males.

Goitrogenic and Other Factors

Iodine deficiency results in goiter, but there may be other factors involved. There are naturally occurring substances in some foods, especially cabbage, rape, rutabaga, turnips, and related plants, which block the utilization of iodine by the thyroid. Certain sulphur-containing drugs act as antithyroid agents, apparently by interfering with the production of thyroxine.

There are genetic differences in susceptibility to goiter. Some research studies also show that infection and contamination of drinking water may be factors in causing goiter.

Food Sources of Iodine

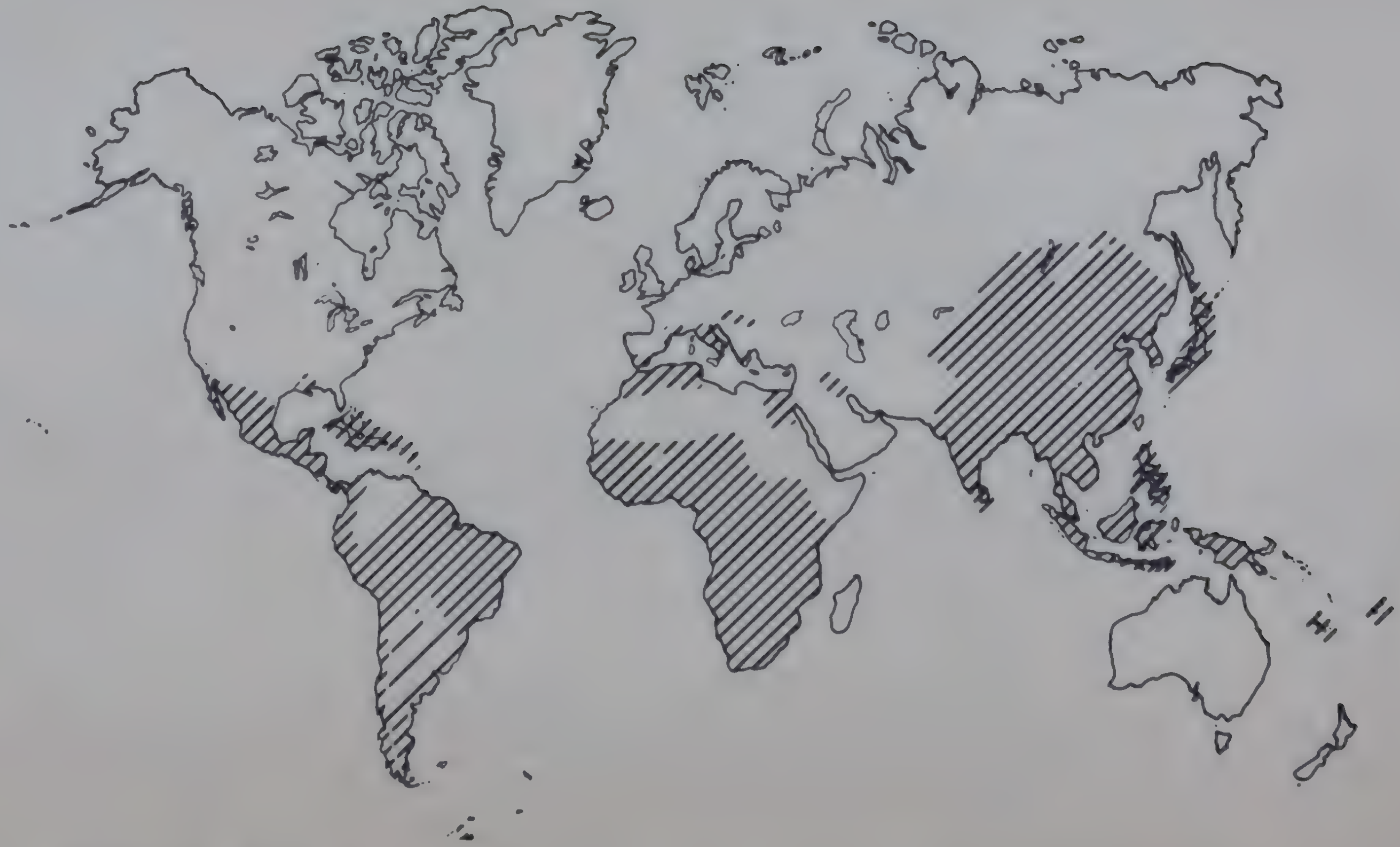
The iodine content of foods depends on the soil in which they are grown; some plants, such as spinach, take more from the soil than others. Seaweeds are rich in iodine because they collect and concentrate iodine from seawater. All seafoods are good sources of iodine.

In general the vegetables, especially green leafy ones and legumes, contain more iodine than cereals and fruits; meat and milk are between these groups. All foods are highly variable, and we do not know where our foods in the markets have been grown. For this reason a practical, economical way to make iodine available to everyone is to add it to salt. Iodine, in the form of potassium iodide, is added to table salt in the United States as a public health measure. No one is compelled to use iodized salt; plain salt is also available in the markets. But iodized salt is a wise choice; it is a means of restoring to salt what was present in the original crude substance before it was purified. Continuous educational programs are necessary to remind consumers of the reasons for choosing iodized salt for cooking and for table use.

Many other countries also use some form of iodized salt; a study group of WHO in 1952 recommended that "all food salts should be iodized compulsorily in any country or area in which goiter is endemic." However, many problems are encountered because in tropical countries the crude, moist salt used renders the iodine compound unstable.

KWASHIORKOR

One of the greatest enemies of good health in the world's children, protein-calorie malnutrition has only relatively recently come into the spotlight. Here we will discuss only kwashiorkor, a severe form of protein-calorie malnutrition. Dr. D. B. Jelliffe, in 1966, said that by "unofficial international agreement the term kwashiorkor is currently used almost universally for this particular extreme form of protetin-calorie malnutrition of early childhood even though there is disagreement about minimum diagnostic criteria."



Geographical distribution of kwashiorkor. (Adapted from: Food and Agriculture Organization.)

Presently in the United States the word kwashiorkor is being encountered in daily newspapers and in widely read magazines. In 1957 major attention was given to it in a full four-page article in the *Saturday Evening Post*.

In 1935 Dr. Cicely Williams used the word kwashiorkor for a disease for which, in a 1933 article, she had described the symptoms seen in twenty cases in Ghana (then called the Gold Coast). She said in 1935 that she used the word merely as a confession of ignorance.

Now it is known that this disease that had at times some fifty different names all around the world is one and the same disease. It had been called "fatty liver disease" or "sugar bady," "m'buoki" in the Congo, "dystrophie des farineux" in French, "mehlnahrschaden" in German, "nutritional distrophy" in India, and "distrofia pluricarencial infantil" in Latin America. The recognition that it was the same disease whether in Guatemala, India, or the Congo represented progress in clinical diagnosis of it.

The word kwashiorkor comes from the language of the Ga tribe, one of the principal tribes in Ghana. Different meanings have been ascribed to this word. One of them, "red boy," probably originates either from the red patches or the bleeding lesions on the legs or other parts of the body. In some children the hair also may show either bands or tips of a reddish hue. Preference seems to be given by authorities to the red skin meaning. Many clinicians, including Dr. Williams, believe, however, that kwashiorkor really means the disease of the "deposed child" or the sickness of "the older child when a new baby is born." Some of the Ga people also say that the word really means "first-second." When Charity Dagadu, a Ga from Accra, Ghana, was a student in the author's class, she said that the Ga mother uses the word kwashiorkor to refer to the jealousy which the first child has for the new baby. According to her, many of these mothers think the disease is caused by this jealousy. In areas of the world where the disease is common, one may find it referred to as "that disease."

Regardless of the original tribal meaning of the word kwashiorkor, it is now well described in medical literature and the need to direct attention to its prevention is well recognized. It had been described as early as 1906 and thought it was caused by a high starch diet. Authorities now recognize that it is the imbalance of protein and carbohydrate in such a diet which causes the condition and not just the extra starch. An early article from Mexico described a disease with a "snakelike" skin which Dr. Cicely Williams had characterized as a "crazy pavement" skin. In 1918, reports of a similar condition came from Africa; a similar condition was described in Japan in 1923, in France in 1927, and in 1929 in Cuba. During the next two decades, reports came from Central and South America, from parts of the Caribbean such as Jamaica, from Hungary, from Greece, from India, from the Philipines, from Fiji, and from Spain.

In 1949 a commission of FAO, the "Expert Committee on Nutrition," met to discuss the reports of this disease which was evidently occurring in widely scattered parts of the world and which was found to respond promptly and completely when milk was given. This milk was usually provided as skim milk powder. Those on this committee must have remembered the 1933 article which Dr. Williams had written sixteen years before. As a result of the recommendations by the committee for further study of this disease, J. F. Brock and M. Autret made a survey in ten countries in Africa south of the Sahara. They then wrote "Kwashiorkor in Africa" which was issued jointly by FAO and WHO in 1952. Shortly after this, similar surveys were done in Central America and Brazil.

Twenty-six people from twelve countries met in 1953 under the sponsorship of the Josiah Macy Foundation to discuss the prevalence, causes, and possible prevention of kwashiorkor. In 1955 at another meeting in Princeton, New Jersey, sponsored by the same foundation, the disease was recognized as a major problem in the world; the participants discussed methods of prevention. In 1956 the Committee on Protein Malnutrition of the Foods and Nutrition Board of the National Academy of Science's National Research Council was created. Its assignment was "to organize and supervise a world-wide research program on high-protein foods for the improvement of the nutrition of populations, particularly of growing children in food deficient countries." This work was supported by grants from the Rockefeller Foundation and UNICEF. More recently the same board appointed a Committee on International Nutrition Problems. An International Conference on "Meeting the Protein Needs of Infants and Pre-school Children" was held in Washington, D. C., in 1960.

After each of these conferences the availability of their proceedings made the findings useful to the scientific community and to the science editors of the popular press. Protein-calorie malnutrition in one of its severe forms is now firmly labeled as kwashiorkor. Investigators have begun to probe the depths of its characteristics in its mild and severe forms, noting its consequences and its causes, both immediate and long-term.

Kwashiorkor occupied a prominent place at the 1965 Western Hemisphere Nutrition Congress held in Chicago and at the 1965 and 1966 annual meetings of the American Public Health Association.

In 1963 another important step in the long history of kwashiorkor was taken at the Villa Serbelloni in Bellagio on Lake Como in Italy. The group meeting there considered how to reach the preschool child, because this postweaning disease was known to affect children from one to four years of age most seriously. Following the Lake Como Conference, at the Sixth International Congress in Nutrition meeting in Edinburgh, Scotland, plans were made for a 1964 International Conference on the Prevention of Malnutrition in the Preschool Child. This was held in Washington, D. C., in early December 1964.

The 1963 Lake Como and the 1964 Washington conferences, by focusing on the preschool-age child, gave prominence not only to kwashiorkor but also to other conditions of malnutrition in this age group ,such as marasmus, xeropthalmia, anemia, and goiter. The lead sentence of the general summary of the report of this 1964 conference gave evidence of this:

> *Malnutrition in the pre-school child is one of the world's most serious health problems in developing areas. Not only is it killing and maiming the children today, but also, through physical, mental, and emotional damage, it will handicap the society of 1984 and the next generation.*

This idea will be explained later in the chapter.

A conference at Schloss Tremsbüttel in Hamburg, Germany, in 1966 considered the administrative aspects of programs to protect the preschool child. After 1963, special programs to reach the younger children had been initiated in a number of countries. Now it was necessary to agree on practical procedures to carry on these programs so that they would be effective at once.

Dr. D. B. Jelliffe, who has spent years working with kwashiorkor, states that "protein-calorie malnutrition in early childhood occurs most commonly in most tropical countries and in some it may be the primary public health problem although not recognized as such."

Because kwashiorkor, along with marasmus, is considered the most serious of the diseases afflicting preschool children in the world today, we have chosen to tell you more about it. We all should be concerned about "that disease" "due to jealousy" "of a red boy" in Africa. It does affect all of us because anything which may handicap the society of 1984 on several continents also surely will handicap every citizen on earth.

The Prevalence of Kwashiorkor

Dr. Marcel Autret, Director of the Nutrition Division of FAO and one of the authors of the 1952 FAO/WHO report on "Kwashiorkor in Africa," in a paper prepared in 1964 for the personnel of the Nutrition Division of FAO, says:

> *It has been admitted for ten years that malnutrition among preschool children—whether it is called kwashiorkor, protein malnutrition or calorie and protein malnutrition—constitutes the number one nutritional problem of our day. Now in these ten years has all been done that could be done to combat it? Certainly not. One has learned to identify the disease and to treat it correctly in a hospital; but one does not know what its incidence is in most parts of the world.*

He also points out that one does not know what its incidence and therefore its relative importance are in a given country such as are known for malaria, tuberculosis, or for yaws. He is concerned because the new food products, rich in protein and made especially for children, really reach only a small part of those who need them.

Many others engaged in international health programs have made statements concerning the gravity of the problem and the lack of concentrated attention and effort to do something until recently. Dr. Paul Gyorgy thinks that "70% of the pre-school children in the developing countries suffer from various degrees of malnutrition."

Some people feel that the majority of preschool children in the developing countries pass through episodes of malnutrition of some degree of severity. How many of these suffer from real kwashiorkor is not known, as will be explained later. For protein-calorie malnutrition, one can find so-called modest estimates of 100 million and possibly a more realistic figure of 170 million. According to Dr. Arnold Schaefer, who has supervised more dietary surveys around the world than anyone else, the overall figure of seriously malnourished children in countries outside the Communistic sphere currently is 269 million and will be 330 million in 1975. Cases of frank kwashiorkor area, of course, hidden in these figures, but malnutrition in general is, after all, the total problem.

The Fifth Session of the Joint Committee of the FAO/WHO Expert Committee of 1957 suggested in its report that "there is a need for simple, objective 'Nutritional Indicators' which can be used by general public health workers with a limited knowledge of nutrition." Dr. J. M. Bengoa, Dr. D. B. Jelliffe, and Dr. C. Perez suggested in 1959 the use of:

> *five possible simple potentially useful indicators derived from the following sources: 1) vital statistics, 2) antropometric measurements, 3) clinical signs, 4) food composition, and 5) laboratory tests.*

They stressed the need for further investigation and stated that "probably a combination based on data from all these sources would be most valuable."

It is easy to understand why data as to the number of cases of kwashiorkor in individual countries are not available. Uniformity and precision would depend upon the adoption and use of predetermined, simple, objective, numerically measurable, specific indicators.

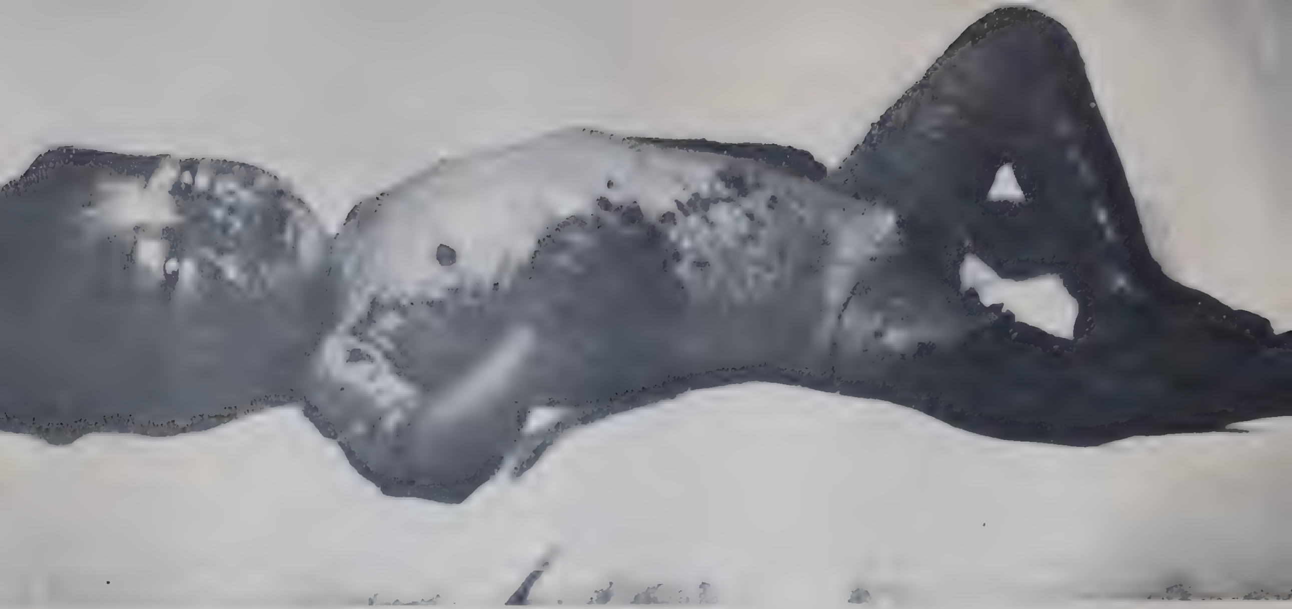
As has been often pointed out by such recognized authorities as Dr. Nevin Scrimshaw and Dr. Arnold Schaefer, the exact number of diagnosed cases of kwashiorkor in relation to the child population of many developing countries is extremely difficult to determine. Many of these children may also have what is now designated as prekwashiorkor.

There are many obstacles to knowing how many actual cases of kwashiorkor exist in any one locality at any one time. Counts are usually taken on those children who come into the hospital. The number of cases admitted to the hospital varies with such factors as hospital beds available and whether the therapy of this hospital is understood and valued by the villagers. It is said that certain tribes in Africa are convinced that kwashiorkor is as inevitable as measles.

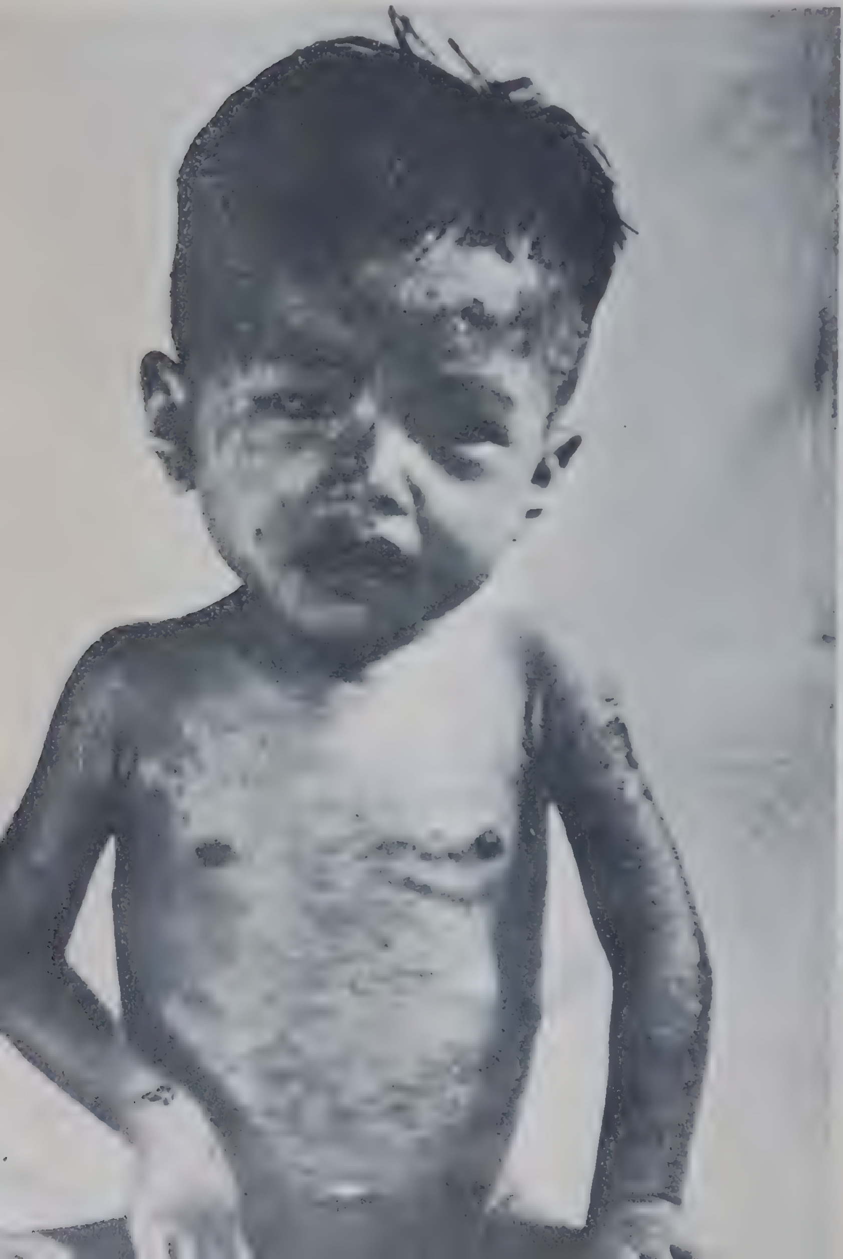
In most places, especially where medical personnel is extremely scarce, no one knows how many of such sick children in the community do not come to the attention of a physician for diagnosis. It has often been said that the analogy to an iceberg is pertinent here and that, for every diagnosed case, possibly one hundred more are undiagnosed and therefore untreated.

Not much help in finding the incidence of the disease comes from the examination of records of death. Often the cause of death is listed as measles or some other infectious disease. These diseases undoubtedly only cause death because the child's body, so weakened with malnutrition, could not combat the infection.

For all of these reasons it is difficult to determine the exact incidence of the disease. There is now, however, a vast literature on kwashiorkor.

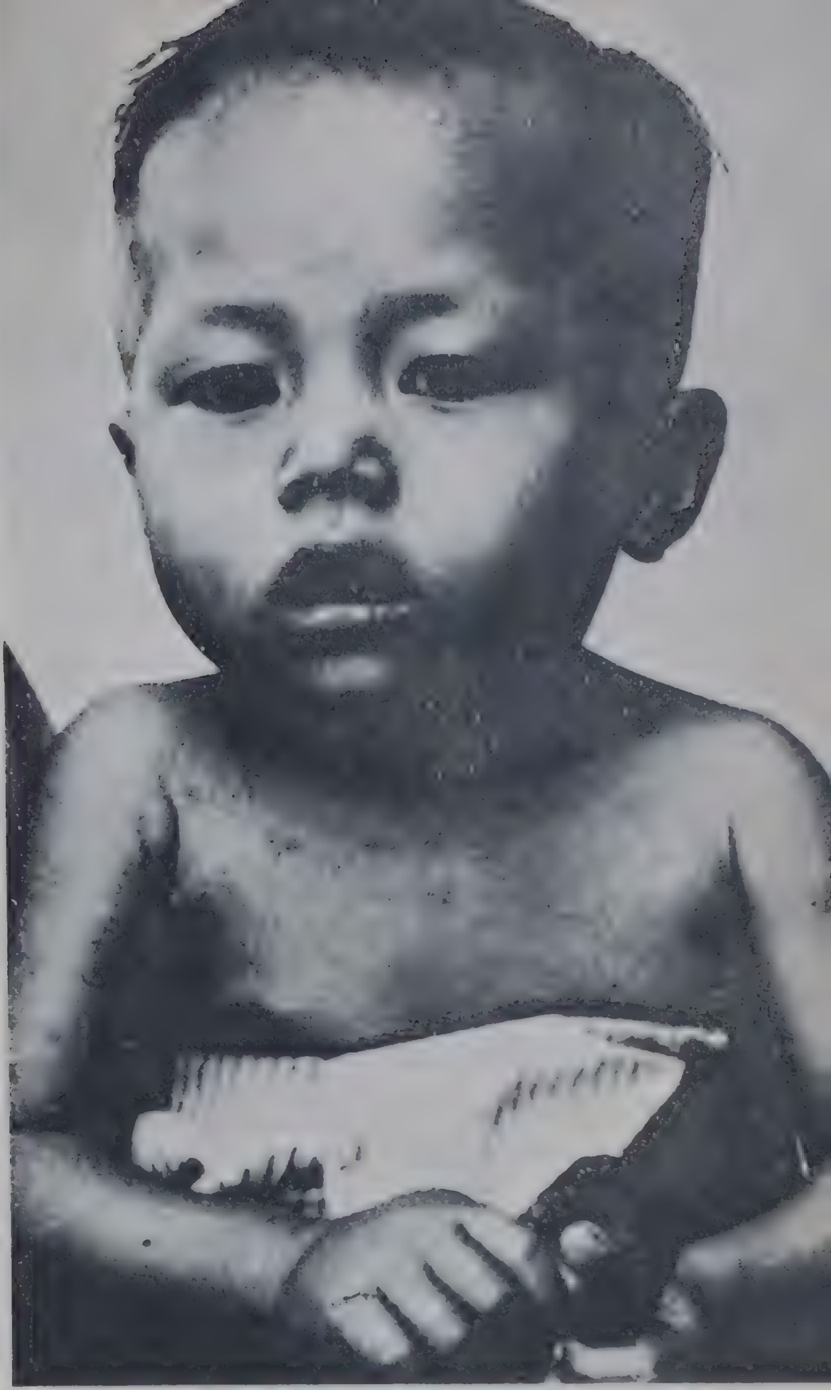


Child with kwashiorkor upon admission to the doctor's care. (Courtesy of World Health Organization)



The same child four days later. (Courtesy of World Health Organization)

The same child after one month of care. (Courtesy of World Health Organization)



We do know that it occurs most frequently in tropical and semitropical countries. Only a few scattered cases have been reported in the United States, a recent one in the Bronx, New York, several in the deep south, and a few cases among the Navajo Indians.

Clinical Features of the Disease

Certain characteristics of kwashiorkor have been observed by those who work with these children. In 1966 Dr. D. B. Jelliffe classified the clinical features of kwashiorkor into: (1) the constant signs, (2) the usual signs, and (3) the occasional signs. He said that the following signs may be regarded as diagnostic if found in early childhood in areas where the diet in infancy is mainly carbohydrate. They are:

1. Edema.
2. Growth retardation.
3. Muscle wasting with retention of some subcutaneous fat.
4. Psychomotor change.

The usual signs, though not necessary for diagnosis, are usually present singly or in any combination. They are:

1. Hair changes.
2. Diffuse pigmentation of the skin.
3. Moon face.
4. Anemia.

The occasional signs are present in some cases and not in others. They are:

1. Flaky-paint rash.
2. Enlarged liver with fatty infiltration.
3. Skin lesions such as fissures behind the ears and a "moist groin rash."
4. Associated vitamin deficiency.
5. Associated conditioning infections.

There is good agreement among those who work with kwashiorkor that retarded growth, showing first in a failure to gain before lack of increase in length is evident, is one of the first signs of the disease. This slow rate of growth is now believed to be caused by inadequate food and not a deficiency of a growth hormone. Workers in Africa have reported that children brought to the hospital at the age of eighteen months often show the weight of a normal five- to six-month-old infant. It has been pointed out that if the mothers and all who care for children in these vulnerable countries could be alerted to the seriousness of failure to grow and gain, much real kwashiorkor could probably be prevented.

Evidence is increasing every day which leads to the belief that, under optimum conditions, growth characteristics are the same in nearly all areas of the world. It is now thought rather generally that racial and genetic factors play a small part in growth failure.

Another feature of the disease which is seen in practically one hundred percent of the victims of kwashiorkor is *changed behavior*. The child becomes irritable, as Dr. Williams pointed out as early as

1933. In extremely severe cases, apathy develops and the child pays little attention to his surroundings. This condition was brought home to the author in a children's ward of the city hospital in Lagos, Nigeria. She saw a change in three days' time in a child with diagnosed kwashiorkor, from total apathy to a whimpering cry. The cry is usually described as a whimpering one which denotes a thoroughly wretched child, often said to exhibit peevish mental apathy. Brock and Autret, in their 1952 report, comment that this clinical aspect has often been neglected. More recently, most authors writing on the subject mention this as one of the prominent features.

Edema, or retention of water in the tissues, is also frequently described as present. In fact, the child with kwashiorkor looks very different from the victim of marasmus, where wastage of subcutaneous and muscular tissue gives an appearance of extreme gauntness. In kwashiorkor, edema gives puffy legs and a distended abdomen as well as the so-called "moon face" appearance.

Skin changes were described by the early writers as "crazy pavement" and "snake-like skin." These changes involve a coarsening of the skin in spots, with dark or heavily pigmented areas in some cases, and light or dyspigmented spots in others. A change in appearance of the skin, which is more noticeable in Negro children than those of other races, has been called a "flaky-paint" skin. Spots, jet black in color, with sharply defined edges, appear on parts of the body. Erosion of the skin and later ulceration forming open lesions or sores may also appear on the affected areas. These secondary infections develop where the skin is broken, especially on those parts of the body which are exposed to the sunlight.

One of the other clinical features of the disease is the change in the color of the hair, as was discussed under the meaning of the name. The hair may be dyspigmented and become grayish white in color or it may take on a coppery reddish hue, either of which is strange looking in the black hair of a Negro child. The reddish tinge, which denotes a lowered amount of pigment available for the growing hair, is accounted for as one accounts for the red and yellow color in the leaves of trees which, in the fall of the year, lose their green color when the chlorophyll dies. The hair color may range from brownish black to brown to pale grayish brown or even to a straw color.

Two types of hair changes may be seen. One shows up in bands of different colors, aptly referred to as "banding" or the "flag sign." This results when the child receives inadequate protein and gives a striking record of the periods of hunger. Brock and Autret tell, in their 1952 report, that when ignorant and uneducated parents in Africa were asked whether the reddish hair was its natural color, they unhesitatingly replied that it was the result of the recent famine. The other type of change of color shows up in tipping of the hair.

Texture changes in hair also occur. The kinky, wiry hair of the African child becomes straight, soft, or even brittle; thin and sparse, it can be pulled out very easily.

All of these hair changes have been observed less frequently in Latin America and India than they have in Africa.

Nowhere in the literature has the author found any statement concerning the shame which the African mother shows for the reddish tinge so that she dyes the hair black. In 1959 this was shown to her by the prominent pediatrician, Dr. Susan Ofori Atta, in a children's hospital in Accra, Ghana. She felt that this manifested shame gave her a good opening for teaching the mother how to prevent the reoccurrence of the reddish tinge.

Another clinical feature which is often found to be present is the enlargement of the liver along with fatty changes in this organ. Abnormality in other internal organs also has been noted.

There is an apparent association of avitaminosis A and kwashiorkor. According to Mahladevan and Ganguly: "The most common and almost inevitable nutritional disorder accompanying kwashiorkor is avitaminosis A." They also say that how kwashiorkor precipitates the vitamin A deficiency is not yet known. It appears that vitamin A is not well carried in the blood plasma of a kwashiorkor victim.

Probably the most alarming change which kwashiorkor may cause in the young child has only recently been recognized. There is an ever-increasing body of experimental evidence showing that severe malnutrition such as kwashiorkor, especially in the young infant, may cause irreparable brain damage and therefore a lessening of the potential for intellectual growth. This damage has been shown in animals to be most serious during what would correspond to an age under six months in the human infant. There is now reason to believe that this same kind of damage from inadequate food may occur in the human infant. Although much work remains to be done to show a direct relationship between protein-calorie malnutrition and permanent damage to the intellectual development potential, many authorities now believe that there is a real possibility that current research will prove such a relationship. Perhaps this is what Ritchie Calder meant in his 1964 statement: "By present neglect, we are exaggerating the problems of the future. We are caricaturing now the world society of 1984."

In summary, then, prominent clinical features of kwashiorkor are:

1. Retarded growth and development which may include intellectual and hence social development.
2. Changed behavior with peevishness and indifference to surroundings being most prominent.
3. Edema, especially in the extremities.
4. Skin changes, dyspigmentation, blotching, and lesions which permit secondary infections.
5. Changes in the hair color and texture.
6. Changes in the liver and other internal organs.

The Role of Infectious Diseases

An examination into the causes of death in children in countries where kwashiorkor is prevalent points to the connection with infectious diseases. In a study of 286 undernourished and malnourished children admitted to a hospital in India in 1957–1960, 123 were diagnosed as kwashiorkor (edematous and fatty type) and 163 as marasmus (wasted type); the mortality was high—twenty-three percent. Fourteen percent died within forty-eight hours after admission and five percent died suddenly in the hospital. The immediate causes of death were given as diarrhea, dehydration, and respiratory infections. It is well known that infection causes a decrease in appetite and water and mineral losses from the body or malabsorption of necessary nutrients from the intestinal tract. Dr. Arnold Schaefer has observed that forty percent of the children of Vietnam die from a combination of malnutrition and infectious diseases, and that the death rate from measles in Guatemala is 325 times what it is in the United States and in most of Europe.

In south India the maximum incidence of hospital admissions for kwashiorkor was noted to occur during the summer months when there were maximum breeding of the common housefly and maximum incidence of diarrhea. In Central America during a measles epidemic, no children in one village who were receiving supplementary feedings died, but that there was a high fatality rate in a neighboring village where no extra food was being given to the children.

It has often been pointed out that the child whose body is weakened by malnutrition cannot withstand a bout of a serious infectious disease. Some have observed that even a vaccination during a period of grossly inadequate protein intake may cause a serious condition. It therefore has been proposed that in countries where kwashiorkor is prevalent, vaccinations be done on very young children before they leave the mother's breast.

Causes of Kwashiorkor

The greater prevalence of this disease in children from one to four years of age leads to the awareness of the really basic cause. A study in Java, reported in 1963, gives a striking illustration of the ages of childhood when most deaths occur. In this study nine percent were during infancy, thirty-six percent during the second year of life, forty percent during the third year, and nineteen percent during the sixth to seventh year.

In many developing countries in the tropics, it is the custom to nurse an infant at breast well up to two years or even more, usually until a new baby arrives. Because of this weaning at the arrival of the new bady, the child loses his chief source of protein. It may also be true that he has been gradually weakened since the age of six months because his mother's diet has been poor and the level of nutrients in her milk has decreased. But now when he is suddenly removed from the breast, he suffers even more from a lack of needed nutrients as well as from the loss of his mother's love and attention. This sudden loss of close contact with his mother may be stark because she must, in her harried existence in a poverty-stricken environment, spend most of her time with the new baby and other household duties. The weanling child thus becomes suddenly neglected in several ways. He may be even taken out of the home to live witn a grandmother or an aunt which involves a real physical separation. Loss of appetite may also follow. Other changes in modes of living may affect this entire picture. It was reported in the WHO *Chronicle* of March 1966, that failure in lactation in communities in Africa is occurring with the increasing urbanization and the "erosion of traditional patterns of behavior." "Improperly prepared artificial foods are being more and more used." In Kampala the incidence of bottle feeding increased from fourteen percent in 1950 to forty-two percent in 1959. The shift was from kwashiorkor to marasmus often complicated by gastroenteritis.

As a substitute for the former breast milk, the newly weaned child is usually offered some kind of a starchy food; in many cultures this kind of food is considered most desirable for a child of this age. Often this food is made with water into a thin gruel or, as it is often called, "pap." In the starchy-root-eating regions of Africa, this watery food may be made from cassava or manioc (tapioca is made from this) or from a large white-fleshed root called a yam which also is low in protein. In Buganda, steamed plantains (similar to banana but must be cooked to be edible) called "matoke" are fed to this postweaned child. In South Asian countries, sweet potatoes are used, and in Latin America and Egypt corn or maize. Thin rice gruels may be used in India. It must be said, however, that kwashiorkor is seen less among rice- and wheat-eating peoples than among the maize- and starchy-root-eating groups due to the difference in the quality of the protein of these foods. The rice gruel fed to children in India may be an inadequate food because the mother, in her ignorance, thinking that it will be more digestible, makes it into a thin food with too much water.

All of these foods of the postweaned child have two things in common. They are:

1. High in starch and low in needed protein, these characteristics varying with the different foods.
2. Highly diluted with water.

Why is he not given animal protein foods?

In many areas his family cannot afford meat, milk, eggs, or perhaps even fish; or these foods may not actually be available. In Africa, the tsetse fly, until international organizations such as FAO discovered and used methods for its control, made the raising of cattle practically impossible.

In some places, although such foods as milk and eggs are available, the child does not get them because of the ignorance and superstition of his parents. In one tribe, eating eggs is considered a sign of greed, because these people think it uneconomical not to let the greater food-producing chicken develop from the egg. In other group, eggs are said to make girls licentious. In Sierra Leone, eggs are not given to children below the age of five years because they are thought to cause them to steal. In Southern Rhodesia, it is believed that they cause baldness and sterility. When a local African in one area sees a person suffering from what a western observer conceptualizes as inadequate nutrition, the African may believe instead that the disease came about because the child's parents broke sexual taboos. There are kwashiorkor victims in cultures where milk is considered a disgusting food because it is a body secretion. In one tribe only milk from cows of the mother's family's herd is considered fit food for her and her child. It is said that milk is so little valued by certain pastoral tribes in the north of Uganda that the people live on millet and give their milk to their herdsmen.

Tribes such as the Masai, who use milk as a food, have no kwashiorkor, whereas their nonmeat-eating and nonmilk-drinking neighbors, the

Kikuyu, have a high incidence. Differences in food habits of people living in areas next to each other make the contrast even more noticeable.

Another cultural factor which operates to promote undernourishment for the preschool child is that his order of demand on the scarce food of the family is low. The father, or the breadwinner, has first call, and all other adults get their share before the small child. These people truly do not know that his growth demands more good food for his size than do their larger bodies.

It has been observed in some places that there is more kwashiorkor among boys than girls, probably meaning that the girl child, as she follows her mother around during the preparation of the family meal, gets handouts.

There is no doubt that the picture, as Gerlach has said, is one of "an intertwining web of social, economic, political, and magico-religious, technological, attitudinal, and environmental factors." We cannot, however, discuss here all of the factors which make the desirable protein-rich animal foods scarce.

As was said before, the poorest protein diet is furnished by the starchy roots of the cassava and the yam. One can only conjecture why peoples in parts of coastal West Africa came to depend on these starchy roots for their calories. In former days, did the well-buried roots represent a sure supply of calories when a plague of insects ate all parts of the plant which were above ground? Or, where an encroaching jungle and the tropical rain-leeched soil made all cultivation difficult, was the reward of calories greater for the women who were the chief agriculturalists?

Prevention of Kwashiorkor

Solving the Problem

As can be readily understood, backgrounds of food habits are extremely complicated; yet they must be understood and the extent of the depth of their roots must be probed before any desired changes can be made. There is, therefore, no easy solution for the problem of protein-calorie malnutrition. It has often been pointed out that two types of goals must be set. There must be immediate relief, and there must be the long-term goal which looks to the future largely in the area of prevention. The latter involves a change in the fundamental structure of the society. The accomplishment of the short-time goal, however, may prepare the people to attack the larger problem and work toward its ultimate solution.

For both kinds of programs, the cultural backgrounds of food habits and foodways must be understood. Also, parents who control the destiny of the preschool child in the family must be led, through education, to understand the food needs for growth and the causes of protein-calories malnutrition. The demonstration of what dry milk and other protein-high foods can do for a kwashiorkor-ill child has to be used to persuade the father, most of all, that food does make the difference. The problem of reaching the father may be greater than that of reeducating the mother. Often, in the developing countries, the mother accompanies the child to the hospital and stays with him while he is being treated. It is quite fortunate, perhaps, that in many cultures the mother cannot think of abandoning her child to a spotless white hospital with strange people in forbidding-looking uniforms. Most public health workers feel that it is an absolute necessity for the mother to stay with the child so that she may be reeducated while the child is being cured. These mothers may feel insecure in leaving their children, as did the mother of a Negro child who was loath to leave her child in a modern, well-run, shipyard nursery school during World War II. The reason she gave was that the teachers would not know how to comb her child's hair. This probably was only symbolic of a deep distrust.

It should also be pointed out that the poor food the weanling receives probably does, in many cases, also reflect the poor diet of the entire family. Often simple procedures for storing or preserving food from times of plenty for use in the hungry months need to be taught.

Dr. Williams believes that the recent increase in malnutrition is the result of neglecting to provide maternal and child health services and due to the practical nonexistence of pediatricians in some areas. She also blames fragmentation of services due to the modern tendency toward specialization. These, in relation to growth in the population and rapid urbanization, have made the problem greater. She urges more use of the nurse and also the spread of family-planning knowledge which she delineates as helping families to have no more children than the parents want. She, as have others, cautions that all problems of malnutrition cannot be cured, however, by even widespread use of family planning.

Many people have pointed out that attempts to relieve the problem of malnutrition should be started on many fronts at the same time. It has been said that, to combat malnutrition, it would take an army of extension workers in addition to medical and other health personnel for the needed teaching.

The Food for Peace program of the United States government, as Dr. Schaefer points out, may be no more than a temporary relief measure unless the requirements for a long-lasting program can be built in so that local governments are helped to assume increasing responsibilities.

President Lyndon Johnson's February 1966 message to Congress also stressed this approach.

There are in operation now a number of general programs which are designed to increase the availability of the supply of local animal protein food. In this connection, mention should be made of all the dairy projects such as the one in Bombay, India, and those which were patterned after that one. This improvement of milk-producing animals and their care has been a great step forward. The efforts to increase the catch and production of fish both in the sea and in fish ponds is another notable effort. As recently as 1965, it was said in a medical journal from India that, although 1.5 million tons of fish are caught in the coastal waters off India, a large part of the catch is unavailable for human consumption because it is so perishable and because of the high cost of transportation. Another extensive effort is the preparation of fish-protein concentrate. This uses fish which might not otherwise be used for human food. The improvement of livestock and the production of meat, as well as the fostering of the raising of poultry and rabbits, can further increase the supply of animal food. Yet it is known that all these efforts are mere beginnings. We are told that the gap between the increase in population and the increase of available foods is widening each year.

All of this has a direct bearing on the prevention of kwashiorkor.

Indigenous Protein-Rich Foods

For immediate relief of the problem of protein-calorie malnutrition, several kinds of protein-rich foods have been devised and tested. In these mixtures the deficiency of amino acids in a vegetable protein needed for growth is made up by another one of the vegetable proteins used. Thus the mixtures furnish all of the amino acids necessary for growth.

Centers for the production and testing of these mixtures have been set up with the assistance of the Rockefeller Foundation, WHO, FAO, and UNICEF. Some of the most notable are in Guatemala City (Institute of Central American and Panama, INCAP); in Capetown, South Africa; in Dakar, Senegal; in Nigeria, West Africa; in Uganda, Central Eastern Africa; in Mysore and Coonor, India; in Mexico; and in Indonesia.

Because these offer perhaps the most specific solution to the problem, we will discuss them in detail. In no way, however, is it implied that the total problem be solved by this production of indigenous and acceptable protein-rich foods in every country where kwashiorkor or even mild protein-calorie malnutrition is found. Dr. Scrimshaw, however, Child enjoying Incaparina. (Courtesy of United Nations)

believes that this is an encouraging development. The movement to find mixtures of foods grown locally which could be used to supplement the local low-protein diet originated at INCAP when he was its director.

The mixture *Incaparina* is currently being made of ground maize, ground sorghum, cottonseed flour, and yeast with calcium carbonate, lysine, and vitamin A added. It is recommended that three glasses of the prepared mixture be given to the child daily. This would furnish a protein content comparable to that of three glasses of milk. The cost is approximately one and one third cents per glass; in 1964 it was reported that milk, if available, would have cost three to four times as much. The Incaparina drink is made by adding one glass of water to twenty-five grams of the mixture and cooking it for fifteen minutes. This is then flavored to taste with sugar, cinnamon, vanilla, anise, or chocolate. In addition to the use as a drink, the dry mixture may be substituted (except in bread) for two-thirds of the flour in most recipes calling for

Proper child care can prevent malnutrition. (Courtesy of World Health Organization)

wheat flour. Incaparina can also be made into puddings or added to soups.

Incaparina has been used successfully to prevent malnutrition, and it has been found to be highly acceptable to the populations where tests have been conducted. It is now on sale commercially in Guatemala and in several other Central American countries, and a group in the southern United States has also begun to produce and market it.

However, Incaparina is not the entire answer to the problem. According to a recent statement, when 100,000 pounds a month were being distributed, only two and one-half percent of the children who needed it were getting it.

Within recent years, other vegetable protein-rich mixtures have been developed and tried in various parts of the world. Pro Nutro has been used in South Africa, Temph in Indonesia, Fortifex in Brazil, Multi-Purpose Food in India, Saradelle in Indonesia ,and Laubina in Lebanon. For protein, Pro Nutro uses soybeans and powdered skim milk; Indian Multi-Purpose Food uses peanut meal; Fortifex uses soya flour; Laubina uses wheat, chick peas, and powdered skim milk; Incaparina as was said, uses ground maize and sorghum and cottonseed meal.

At the present time, trials using the press cakes after oils have been extracted from soya beans, cottonseed, peanuts, sesame, sunflower, and other seeds are proving encouraging. This press cake material furnishes a cheap source of valuable protein.

In 1966 attention was drawn to preliminary tests made in a number of countries on new high-protein blended foods. One, called CSM-Mix, made of gelatinized cornmeal, soy flour, nonfat dry milk, vitamins, and minerals, comes in powdered form and can be made into a drink by boiling it with water for one minute. The early good rate of acceptability of these foods has been encouraging and has caused the United States government and voluntary agencies to step up distribution. Such food was supplied to maternal and child welfare and school-feeding programs beginning in 1966.

To summarize and point to the requirements for these protein-rich foods, we quote from an article by the late Dr. R. F. A. Dean. He lists the following qualities as required:

> *The food should be:*
> 1. *Acceptable to children and to their parents.*
> 2. *Cheap and processed from local ingredients.*
> 3. *Keep well even under poor conditions of storage.*
> 4. *Mix easily with staple foods.*
> 5. *Be bland.*
> 6. *Capable of being used as a drink.*
> 7. *Rich in proteins, minerals, and calories.*
> 8. *Contain protein of high quality.*

It has also been pointed out by numerous workers in the field that the child with kwashiorkor usually also needs extra calories added to his present diet. Often the bulk of the food used to increase the calories and protein becomes too great for him to consume unless fat is used for the extra calories. Trials in India proved that the children observed could tolerate butter added to the diet. Some workers caution that with kwashiorkor the production of digestive enzymes that split fats is de-

Molab, an Iranian girl at four months of age. (Courtesy of Food and Agriculture Organization)

creased; therefore, fats should not be fed for the first two to three weeks of treatment.

Recommendations

In summary, a few of the many recommendations for the prevention of kwashiorkor will be given. No attempt is made, however, to give an inclusive list.

1. The national governments where the problems exist must be informed; most programs succeed better if they emanate from these national governments.
2. The control of infectious diseases is needed.
3. The breeding and introduction of improved varieties of corn, wheat, and rice, and the cultivation of soya beans and other legumes can improve the quality and quantity of protein-high foods available for children vulnerable to malnutrition. Efforts to produce varieties of corn higher in the amino acid, lysine, than we now have are important.
4. The introduction of better types of poultry, cattle, and swine,

Molab, now at ten months of age. Food and careful nursing made the difference. (Courtesy of Food and Agriculture Organization)

and the development of a modern dairy industry including milk plants to produce skim and whole milk would help.

5. Above all, mass education is needed. This program would mean reaching individual fathers and mothers to help them understand that protein-high foods are essential for the growth of children. It would mean reaching mothers to get them to wean their infants gradually on a diet rich in high-quality protein foods which are digestible and palatable to the infant.
6. Evaluation of existing programs has been called for by such an authority as Dr. Autret. It has been said that there should be a thorough investigation of programs with careful evaluation to find out specifically what programs have succeeded and why.

STUDY QUESTIONS

1. What are the basic causes for some of the problems in malnutrition in:
    a. The American Eskimo?
    b. The American Indian? (Choose a particular tribe.)
    c. The children of migrant workers?
    d. People over sixty-five in the lower socio-economic classes?
2. How do climate, economics, cultural and social patterns, transportation, communications, education, and religion affect the incidence and severity of malnutrition?
3. Why is xerophthalmia found in greater numbers of children in arid countries? How is goiter related to geography? Why has rickets followed initial industrial development? Why is obesity increasing rapidly during the decade of the 1960's in Europe?
4. Can you choose a country and describe the steps and procedures you would use to introduce iodized salt and get it used by the village homemakers?
5. Not all states in the United States have enrichment laws. Can you discuss the pros and cons for enrichment? Why is enrichment successful in this country but might not be in some other countries?
6. Why does protein-calorie malnutrition occur most frequently in tropical countries?

TOPICS FOR INDIVIDUAL INVESTIGATION

1. Write an article for laymen who have a nonscientific college education telling the story of pellagra so that they understand the importance of diet in this disease.

2. On a world map show where each of the six principal sources of calories is consumed in greatest amounts. Indicate the flow of some of these foods from where they are raised to where they are consumed.

3. Discuss the chief causes of the five most frequent problems in malnutrition in the world today.

4. From reports from UNICEF, FAO, and WHO, list four or five ways in which programs in two countries are planned to prevent kwashiorkor.

5. Imagine that you are a nutritionist in some African country. Describe what you would need to know before you began a nutrition education program.

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8

NUTRITIONAL CHALLENGES OF THE FUTURE

The whole of man's history is a struggle to master his environment and to keep alive a species which, without natural protection of any kind, seemed least likely to survive. But in the western world he has flourished to such an extent that he has overcome the force of gravity of his planet and has ventured into space. Space travel refers to flights beyond 120 miles of the earth's surface. The length of the space trip may be days, weeks, months, or even years.

FOOD IN SPACE EXPLORATION

Space feeding is developed around three categories of flight duration—short, intermediate, and long. Short flights would last from two to three days, intermediate flights for a few months, and long flights for several years.

Problems of Flight

The problems involved in all three stages of space exploration are some of the same problems that have plagued all exploration throughout history. How can food be provided in the proper quantity and quality so as to ensure a good diet and thereby help to keep up morale? How can the weight and storage factors be solved? Space flights have some additional difficulties of a technical nature. For example, oxygen must be supplied and human wastes must be disposed.

Beyond one hundred and twenty miles, zero gravity is a reality. While on earth, we are constantly under the force of one "g." As we ascend into orbit, we face a force of up to fifteen "g." The astronaut then weighs fifteen times as much as he did on earth. His muscles must work fifteen times harder. Once he is in space the "g" force becomes zero and he is in a weightless state. A cookie raised to the mouth would continue its flight up to the ceiling and be reflected back. Floating particles are particularly dangerous as they might enter the astronaut's lungs or infiltrate into the mechanical devices of the space ship. The biggest problem however in space nutrition is weight.

Solutions to the Problem

On flights of short duration, liquid oxygen, stored water, and ready-to-eat food can be used. In preflight feeding, the astronauts are given a high-protein, low-residue diet. These foods are put in collapsible squeeze tubes which allow the semisolid foods to withstand the fifteen "g" without crumbling. Squeeze-tube eating is quite simple. The spaceman simply uncaps the tube, inserts it into his mouth, and squeezes the cylinder. Food packages using a laminate of polyethylene aclar and nylon and containing concentrated and freeze-dehydrated foods can cut to one-half the seven pounds of food which man consumes per day on earth. However, water requirements are increased due to the need of reconstituting the dehydrated foods. To reconstitute the food, the astronaut inserts a hot or cold water tube into the mouthpiece. A sealed membrane below the mouthpiece is then punctured with the probe and a measured quantity of water is added. When food is to be eaten, the neck of the package is inserted in the mouth and food is worked upward until expelled.

It is desirable to provide the astronaut with a variety of good tasting menu items; freeze-dehydrated foods fulfill this need. Meats with gravies, fruits, and fruit juices are easily reconstituted. Edible coatings of bite size solids give protection against vapor pick-up, oxidation, and microbial spoilage. They are also used to reduce weight load. Bacon squares, cereal squares, fruit, and cake cubes add variety and allow the astronaut a normal chewing reaction.

An important requirement for space food is that it be of such quality as to reduce the stress of space flight to a minimum. It can make a difference between poor food consumption, low morale, and monotony on the one hand and high consumption, good morale and efficiency of operation.

Weight limitations do not permit the storage of food, water, and oxygen on flights of intermediate duration. Man needs five liters of water per day and one and one-half pounds of oxygen. Water is very heavy. For these flights, scientists think that water must be recovered from the atmosphere and from body wastes and made safe for use.

For flights of long duration—for interplanetary travel—the food must be provided by a closed ecological system. It is not economical to carry food. This system makes use of plants to provide food and oxygen for the astronaut; it uses carbon dioxide and urinary fecal products for nourishment of the plants. Algae can produce sufficient oxygen to support a man and will use up his respirated carbon dioxide. This closed ecological system in a sealed cabin is theoretically feasible.

It is apparent that the problems of feeding future spacemen are numerous and complex and interwoven. But the history of man gives mute testimony to his tremendous adaptability to his environment wherever he survives. Feeding man in space will not deter his exploration of this new realm of the universe.

FOOD FOR THE FUTURE

Food Shortage

Populations unchecked tend to grow more rapidly than sustenance. A severe strain on the food supply necessarily follows—today more than a billion people are ill fed. The serious food shortage in the world is one of high-quality protein. New protein foods must be discovered and productivity of existing foods must be increased to alleviate this shortage. Without a surplus and better food, underdeveloped countries cannot hope to industrialize and improve their level of living.

Food Production

The chemical era is just beginning. Farmers are using millions of pounds of scientifically designed chemicals to control plant disease, kill grasshoppers, destroy nematodes, stimulate poultry to a more rapid growth, and accomplish other feats which improve agricultural production. In addition, farming techniques, fertilization, and irrigation methods are improving.

For example, it is believed that rich agricultural lands could be developed out of many of the world's arid regions by irrigation with salt water under the proper conditions. Experiments in the Negev Desert of Israel on ten species of plants proved that crops such as melons and tomatoes can be raised with this irrigation. Similar experiments with wheat in India, with fodder in West Germany, and with cereals and vegetables in Italy backed up the results in Israel. The Negev experiments showed that six species could be grown economically if they were irrigated with sea water containing from 1 to 1.3 percent dissolved solids; four species survived irrigation with greater than 3 percent dissolved solids. A wheat grass, which is suitable for hybridization with wheat, was among the species grown. The possibility of breeding salt-tolerant cereals is thereby raised.

In a recent speech, Secretary of Agriculture Orville Freeman drew a picture of our future society and food production potential.

> *Now let's dream a little about a time farther down the road—when you will be my age. We in the USDA have been speculating about the year 2000—the dawn of the 21st Century.*
>
> *First, let's take a quick look at the farms of the year 2000.*
>
> *Most of today's crops will still be grown. But they'll be different, grown from redesigned, sturdier plants that mature much faster than now.*
>
> *The pesky weeds of today will be laboratory curiosities.*
>
> *You will never see—much less swat—a housefly, and many other insects. Livestock will grow to market size on a third less feed and in a third less time than now. Hens will be on an 18-hour cycle, and they'll lay not 240 but up to 400 eggs a year.*
>
> *Only about 2 million people in the United States will be actively engaged in farming. But there will be good jobs in related fields. Computer-controlled machines will plant and irrigate the crops, fertilize by prescription, determine when produce is ready for market, harvest on order, and grade and package the commodities for delivery by supersonic cargo planes to fully automated warehouses.*
>
> *Yet—despite the size and the cost of these farms of tomorrow—they will still be family-owned and operated.*

Now what about other parts of America? Here is what we foresee 33 years in the future.

A land of 300 million Americans living in less congestion than 200 million live in today.

Urban centers free of smog and blight, with ample parklands within easy reach of all.

A Countryside U.S.A., dotted by new towns and growing rural communities where the benefits of community life are enhanced by the rich beauty of the land.

New industry and factories throughout rural America, providing the necessary economic underpinnings for the good life in the country.

A land free from devastating floods, with clear rivers scrubbed of pollution and silt, and sparkling air.

Long before the year 2000 we will have closed the nutrition gap for the people of America.

In the world at large, thanks in large measure to agricultural space satellites already developed, the war on hunger will have been won.

New Protein Foods

Wild plant-eating animals in many tropical bush areas generally yield more protein per pound than the domestic species. It has been suggested that with skilled breeding, they could be improved. Giraffe, hippopotamus, elephant, buffalo, and more than twenty varieties of antelope are suitable for husbandry.

There are large surpluses of cereals in some Western countries. Scientists have been working to develop strains with a protein content of higher biological value. A strain of maize already has been developed with sixty-nine percent more lysine than the normal seeds. Such cereal foods may well replace milk and meat to a large degree because cattle raising requires large areas of pasture. Many forecasters predict a decline in meat consumption in industrial countries. Meat substitutes are already being produced. Ham and sausage made from vegetable protein substitutes are similar in texture and flavor to the real products. Soybeans are a vegetable protein of good biologic value for use in these substitutes. Sausage is also being produced from fish and sold in Icelandic shops today.

In some underdeveloped countries, low-cost, protein-rich foods such as Incaparina (described on pages 245–246) and Pronutro (soya, peanuts, and fish) already are distributed. Another possibility worth considering for human consumption is protein meal which can be produced from oil seeds, chiefly soybeans, cotton seeds, and peanuts after the oil has been extracted. The meal has a protein content of about fifty percent. At present it is sometimes used as animal feed or fertilizer. After the extraction of harmful components such as gossypol in cotton seed, the destruction of enzyme inhibitors in soya, and the prevention of infestation that produces aflatoxin in peanuts, the meal could be used as a food source if carefully processed.

Plant proteins are sometimes mixed to form proteins of high biological value. It has been suggested that amino acid differences in plants might also be made up by fermentation factories which could be set up in underdeveloped countries using local cane sugar. The amino acid thus synthesized could then be added to food or flour. Leaves from many species of plants are potential protein sources. Research already has begun on how to extract leaf protein from plant fibre.

The major food of the future might well be yeast. Torula yeasts can manufacture protein more rapidly than other plants or animals. They can be grown on waste liquor from papermills. Using only a few square yards of surface, half a ton of yeast yields fifty tons of protein.

Fried bee pupae also is a possible food for human consumption. It has been compared in taste to walnuts, pork crackling, sunflower seeds, and rice cereal. In the northern prairies of Canada, about one hundred and thirty tons of bee pupae go to waste every year. This human food of up to eighteen percent protein was eaten by ancient man.

Man again has turned to the sea for life-giving protein; it has been said that this milieu can produce five to ten times as much living matter as can the land. Only about one percent of our food comes from the sea and only a few species of sea life are considered edible. Some scientists feel that the full harvest of the sea has not been reaped and that the food chain could be shortened by harvesting the intermediary stages. For example, the largest and the strongest creatures of the sea, a species of whale, feed on a high-protein diet of planktonic crustaceans known as krill which taste somewhat like shrimp. About one thousand pounds of krill per acre per year are produced in the Antarctic Ocean. However, if a larger harvest of krill was taken the whales might possibly disappear. Other scientists feel that the best method of utilizing organic matter of the sea is still through the natural harvesters—fish, larger invertebrates and mammals.

The more optimistic estimates of the fish crop which might be harvested are somewhere from four to thirty times the present production. The more cautious estimates indicate that the harvest could only be increased two or threefold before stocks were depleted. The annual wet weight of the fish catch has increased in the last ten years from twenty-nine million tons to fifty-two million, yet human consumption of fish has declined from eighty-three percent to sixty-three percent. Fish protein is in demand for feed for chickens, cows, and hogs. Fish meal is fed to livestock and poultry, which in turn are fed to people. A more efficient route might be for humans to consume the fish directly. Whole fish, ground, heated, and treated chemically to produce fish flour, may provide one approach to supplying protein for one fifth of the world's population suffering from protein deficiency. There are problems, however, which must be overcome before fish flour becomes an acceptable form of food.

Some scientists suggest that we eat algae as did the Aztec Indians thousands of years ago. Chlorella, a fresh water algae, is now being cultivated by the Japanese on an experimental basis. The greatest problem is that of flavor. But when the particular flavor of algae is bleached out and artificial flavoring is added, it can be made to taste like meat and vegetables.

Incaparina

Protein malnutrition, especially among young children, is a major problem in Central America where protein foods of animal origin are scarce and expensive. In its earliest studies the Institute for Nutrition in Central America and Panama (INCAP) found a high incidence of protein malnutrition in the countries it surveyed. How to prevent this disease was the challenge. At the National Institute of Agriculture in Guatemala, work was done in 1950 to find sources of protein for animal feeding. It was realized that a similar approach might be used to meet human needs, so this Institute of Agriculture and INCAP cooperated in their search for indigenous products high in protein but low in cost. Many combinations of foodstuffs were tested biochemically and clinically until a mixture of ground dried corn (maize), ground sorghum, cottonseed flour, torula yeast, calcium salts, and vitamin A was found satisfactory.

The product itself resembles a food which is a customary part of the diet in Central America, an "atole" or beverage made of cornmeal and water. The new vegetable-protein mixture was given the name Incaparina. Its nutritive value is similar to milk both in amount and quality of protein; one pound of Incaparina is biologically equivalent to eighteen glasses of milk. The crucial test was whether the product would be accepted by children and adults. Acceptability trials were made in several communities in cooperation with the Ministry of Health in Guatemala. Children drank Incaparina willingly.

Incaparina is low in cost; it is manufactured commercially and sold in packages containing enough mixture for three glasses at a cost of a little over one cent per glass. Increased production and extended consumption can probably lower the price. INCAP receives no profit from the sale of Incaparina. Although commercial firms are authorized to produce and distribute Incaparina, they must submit their product for periodic analysis by INCAP so that standards of quality are maintained. The product is manufactured commercially in Guatemala and Colombia; and other countries are now conducting marketing trials.

Multi-Purpose Food

During World War II, Clifford Clinton, President of Clinton Cafeterias, gave Dr. Henry Borsook, the eminent biochemist at the California Institute of Technology, a five thousand dollar special grant to develop a nutritious food. This food was to be made from nonrationed ingredients and have a cost low enough to be practical. Mr. Clinton, the son of missionary parents in the Orient, had made free meals in his cafeterias available to the needy. After the war broke out, when food rationing went into effect, he realized that he could not continue his previous charity.

Dr. Borsook compounded what was named Multi-Purpose Food (MPF) from toasted soy grits, calcium carbonate, vitamin C, niacin, vitamin A, riboflavin, vitamin B_6, thiamine, vitamin D, potassium iodide, and vitamin B_{12}. This mixture is fifty-percent protein. It was made to have low-moisture content so that it would store well and need little storage space. Multi-Purpose Food can be used as a gruel, sprinkled over ready-to-eat cereal, or used in milk for a cereal topping. It can also be stirred into milk, tomato juice, or fruit juice to be used as a drink. It is, of course, precooked and ready to eat, and it has been found in tests to be acceptable to many people. It is also cheap.

Mr. Clinton organized Meals for Millions, a nonprofit organization, whose mission was to distribute Multi-Purpose Food in areas where malnutrition was present. Now, after twenty years, Multi-Purpose Food has been distributed in over one hundred and thirty countries, according to a December 1966 statement made by the General Mills Company. During 1946–1959, it was made by a well-known spice manufacturer in California. In 1959 the General Mills Company took over its production when they agreed to produce it more cheaply and to pay the Meals for Millions a royalty on the commercial sales of this product. It is now also produced in India, Japan, Mexico, and Brazil.

Multi-Purpose Food is now sold to independent relief organizations, such as Church World Service, to be donated to local missions for relief feeding. Dr. Tom Dooley and Dr. Albert Schweitzer used it in feeding their patients. It has been used as a means of combating kwashiorkor.

The Freedom Meal

In his message to Congress on February 10, 1966, President Johnson said: "We will continue to encourage private industry, in cooperation with government, to produce and distribute foods to combat malnutrition." This message called for the expansion of shipment of foods to countries needing them where there were efforts in self-help. It also proposed the elimination of the surplus concept of food and a continued expansion of markets for American agricultural products.

Shortly after this, the research program of the State Department of Agriculture and Economic Development of Nebraska contracted with the Midwest Research Institute of Kansas City, Missouri, to develop a food to be called a Freedom Meal. By mid-June the product had been compounded according to specifications.

This meal, a cereal product with twenty-percent protein content, contains twenty-five-percent milo (sorghum), twenty-five-percent corn, twenty-five-percent wheat, fifteen-percent soy meal, and ten-percent nonfat dry milk. Vitamins and minerals are also added. All of these foods are produced in Nebraska; therefore the production of this product benefits Nebraska's farmers as well as furnishing food to be used by the world's needy.

This blended cereal can be eaten after cooking for one or two minutes. The shelf life is the same as for any dry cereal. It meets the requirements set up by the United States Department of Agriculture for a foodstuff in the Food for Peace program. These are:

1. Wheat or corn should be the basic component.
2. It should contain twenty-percent protein.
3. The protein supplementation should be provided by a combination of soy and nonfat dry milk.
4. Vitamin and mineral supplements should be included.
5. It should have a bland flavor and a low bran content.
6. It should be partially cooked and ready for serving after one or two minutes of boiling.

Later, the millers and grain processors in Nebraska and the government officials were called to a meeting by the Governor of Nebraska to work out details of the contracts. This group in Nebraska was the first group to work on this problem. They also developed a survival cracker called Nebraskit which they say will keep for five years. This cracker contains wheat flour, corn flour, corn sugar, hydrogenated fat,

Fish is a staple in the Japanese diet. (Photograph by Philip Gendreau)

salt, nonfat dry milk, and dried whey. Following the introduction of the Nebraskit, a milk bar was developed from corn sugar, fat, powdered malt, nonfat dry milk, and dried whey. This bar is said to have a shelf life of six months.

Fish and Fish-Protein Concentrate

One of the major possibilities for increasing the world's supply of protein is in greater use of the fish in the sea. A number of technically developed countries have, through improved boats, gear, and equipment, increased the yield over fifty percent from 1938 to 1958. In 1938 the Danes landed 15,000 tons of herring, sardines, and anchovies, whereas in 1957 they landed 225,000 tons of these fish.

By 1960 India had joined the countries whose yearly catch exceeds one million metric tons. In recent years Peru has improved her annual catch so that this now approximates seven million tons. Peru now also has first place in the production of fish meal which is largely used as food for livestock and poultry.

The large factory ships used to process fresh fish at sea are now being used by Britain, the Soviet Union, the United States of America, and Japan.

Yet with all of these developments the real need is to give help to the developing countries who most desperately need the high-protein fish as food. FAO has a vigorous program to help in this endeavor. As yet in many parts of the world, fish is used as food only in thin areas surrounding the ocean because it is difficult to preserve and distribute. The preparation of fish-protein concentrate which can be used as human food in a variety of ways is one effort to better utilize this source of protein.

Fish-protein concentrate prepared by dehydrating, defatting, and deodorizing fish has several advantages. It contains little moisture and it therefore has as high as seventy to eighty-five-percent protein. Because of this, it is highly compact; a truckload contains four to five times as much protein per pound as the same amount of fresh edible fish. Also, fish-protein concentrate keeps well; if properly packed in plastic bags, it can be protected from insects. The loss of fresh fish from insects and rats is a grave problem. It is said that in Mali as much as forty percent of the fresh fish catch is eaten by beetles and other insects before it reaches the market; in the delta of the Niger River, fifty percent of the catch of fish is eaten by rats. Fish-protein concentrate can reach the consumer in perfect condition. Furthermore, this product is versatile; it can be used in soups and stews as well as with cereals and grains in breads, cookies, or biscuits. It has been accepted well in various parts of Latin America, Africa, and Asia where it has been used in school lunches, in hospitals, in workers' canteens, and in army mess halls. It is currently being manufactured in a number of countries such as Canada, Denmark, the United States, Iceland, Norway, Sweden, South Africa, and Peru. The Bureau of Commercial Fisheries of the United States sought 1.7 million dollars for the fish-protein concentrate program for the fiscal year of 1968. Recently the Federal Food and Drug Administration ruled that fish-protein concentrate is an acceptable product as a food additive in this country.

Fresh water ponds also offer a potential source of fish as food. These are being developed by FAO and assisted by AID technical staffs in many parts of the world. It is said that the inland waters in the Indo-Pacific region offer thirty-seven million hectares (148 million acres) of cultivatable waters for producing fish.

Those who have studied fish culture believe that 500 billion tons of fish could be taken yearly from the world's seas and oceans without upsetting the natural balance. So experts say that the sea holds the key to one of the best answers to hunger in the world.

Synthetics

In the future, we may feed our domestic animals synthetics. Our carbohydrates may be manufactured from straw or waste paper. Fats made from hydrocarbons derived from coal oxidized to fatty acids and combined with synthetic glycerine may be our future triglycerides or fats.

Water

Water is one of the most important of our raw materials. It is an essential to life and to industry. Leaders in public life and hydrologists are at present much concerned about the water supply of the future. We have been and are continuing to pollute our lakes and rivers with industrial and human wastes, and new sources of potable water are being exhausted. The problem is one of quantity as well as quality; since the sea is the source of all water, the economics of the distillation of salt water is constantly under study. The challenge of "water, water everywhere and nor any drop to drink" caused Aristotle to describe methods of extracting fresh water from the sea in 350 B.C.

Consumer Acceptance

Perhaps our biggest problems of the future will be how to change our food habits and how to create consumer acceptance of the new types and forms of protein food. Getting people to use a new food is one of the most difficult things one can attempt. But man through history has eaten about everything and anything, and food habits can and do change.

INSURING ADEQUATE DIETS

Because this discussion does not purport to be all inclusive, we have chosen to tell about only a few ways of changing food habits in detail rather than to mention many methods.

Methods for Changing Food Habits

Discussion-Decision Method

Dr. Ben Willerman, working under Dr. Kurt Lewin in 1942 in Iowa City, investigated the relative effectiveness of two methods of changing food habits. He used the so-called *group decision method*, in which the group decided for itself whether it wanted to change and to what degree it wished to change. The second method, with which the first was compared, was the *request method*, in which a group was asked to make a change and the goals were set outside the group. Willerman's 1942 experiment concerned the increase in consumption of whole-wheat bread as compared with white bread. It must be remembered that white bread, which was not then enriched, contained less of the needed nutrients than did whole-wheat bread.

Men from eight cooperative dormitories at the University of Iowa were used. The eight groups, containing from twenty to forty-four men each, were arranged in four pairs of groups, matched on similar consumption of whole-wheat bread. One of each of these pairs was to make a group decision, and the other was presented with a request.

For the week before and during the experiment, no breadstuff except white and whole-wheat bread was served. Waiters counted the slices of bread eaten during both periods and made certain that as much bread as was wanted was available. The student proctor in each dormitory read a letter, by an authority, to the decision group which urged the students to eat whole wheat bread. Then he called for a discussion. At that time, if the group agreed to cooperate, they set their own goals of how much they would increase the consumption of whole-wheat bread. In the request groups, the proctor merely read the request letter and asked for comments. The amount of change for the *request group* was set at the same level as the amount which had been chosen voluntarily by the *decision group* with which it was paired. The results were obtained from a questionnaire filled in by each student at the end of the experiment.

From their previous levels of fifty percent consumption of whole-wheat bread, one group voted to go to sixty-six percent, another to ninety percent, and two to one hundred percent—the group designated as the D group being one of the latter. In the *request groups*, forty-eight percent reacted favorably, whereas seventy-eight percent in the *decision groups* were favorable with the proposal as read. Although the majority (eighty percent for *request groups* and eighty-six percent for *decision groups*) considered the request reasonable, only twenty-two percent of Group D considered it so. It must be pointed out that in Group D, a *decision group*, the one hundred-percent level of change was arrived at after a bitterfight in which a small vocal minority swayed the decision.

The results showed that with the *group decision* method:

1. A more favorable attitude was created.
2. Individuals were more eager to succeed.

3. The wish to cooperate was more independent of personal likes and dislikes.
4. There was a "kickback" in the groups where the decision was based on too small a majority. This made the outcome less favorable than with the *request method.*

Others later working under Dr. Lewin (housewives who were asked to consider changing for the war effort) obtained similar results in trying to introduce a new vegetable, escarole, and organ meats such as kidney, brains, and heart.

Marian Radke and Dorothy Klurisch, in 1947, used the methods described by Willerman in trying to change infant-feeding practices and later in increasing milk consumption in families of low socioeconomic status. They say, "The group decision method was significantly more effective in leading mothers and housewives to action than were either individual instruction or lectures."

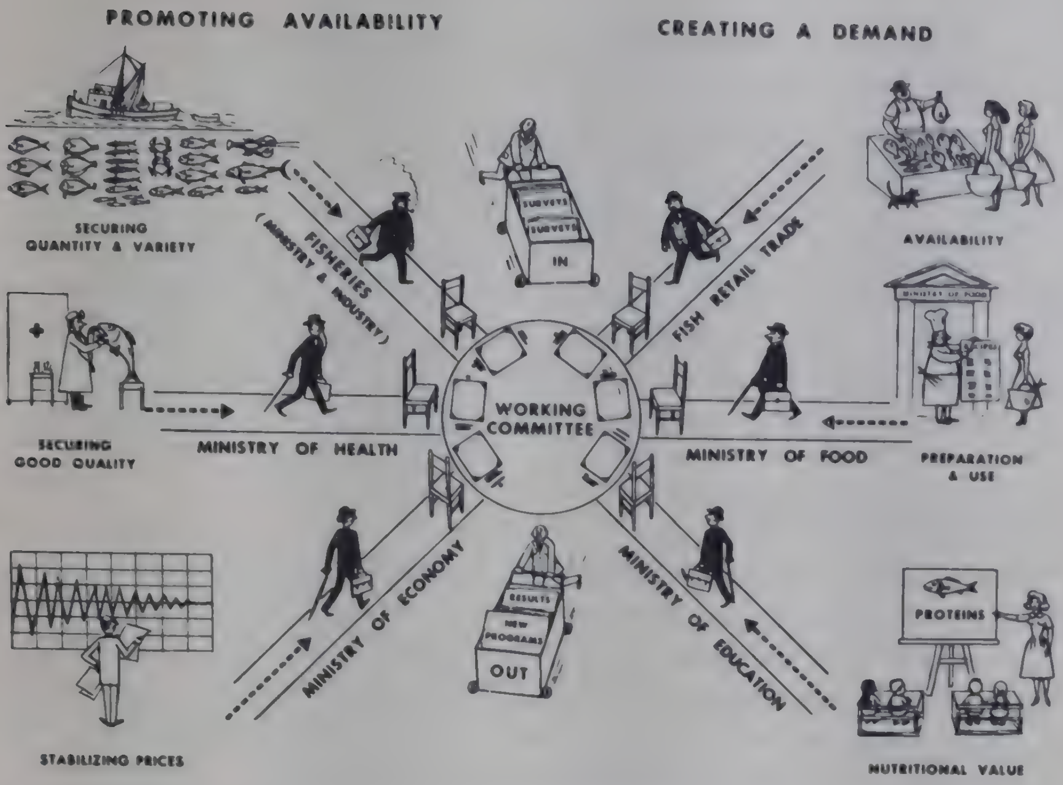
Dr. Lewin's explanation of why the group decision method works better is worth reviewing here. He states that he believes the effectiveness of the method is due to:

1. The higher degree of individual involvement required in the discussion method.
2. The existence of resistance to change, perhaps due to a disinclination to deviate from a social norm or from standard group values. The discussion method offered the individuals the chance to see how others felt on the question, thus making their own decisions easier.
3. The group decision method placing full weight behind one of the two conflicting alternatives so that one choice completely displaces the other.

He also says that when the force to change is facilitated, resistance is lowered and vacillation ceases. He says, further, that the process of social change is a three-step procedure: (1) unfreezing the old level, (2) moving to the new level, and then (3) freezing at the new level of performance.

Marian Radke and Elizabeth Caso, in 1948, tried a similar method, which they called the lecture and discussion-decision method, with junior high school students in Newton, Massachusetts. They used the improvement of poor school lunch habits as their goal. Again the discussion-decision method proved superior, and improvement proved more lasting with this method.

Perhaps some of our ineffectiveness to bring about changes in food


PROMOTING AVAILABILITY
CREATING A DEMAND
SECURING QUANTITY & VARIETY
FISHERIES (MINISTRY & INDUSTRY)
SURVEYS
SURVEYS
IN
FISH RETAIL TRADE
AVAILABILITY
MINISTRY OF FOOD
WORKING COMMITTEE
SECURING GOOD QUALITY
MINISTRY OF HEALTH
MINISTRY OF FOOD
PREPARATION & USE
RESULTS
NEW PROGRAMS
OUT
MINISTRY OF ECONOMY
MINISTRY OF EDUCATION
PROTEINS
STABILIZING PRICES
NUTRITIONAL VALUE

A working committee promotes cooperation by teaching people to use fish as food. (From: John Fridthjof, *Encouraging The Use of Protein-Rich Foods,* FAO, Rome, Italy, 1964.)

habits should lead us to pay more attention to these theories and researches of Dr. Lewin and others.

Public Health Needs for Change

Dr. D. B. Jelliffe and Dr. F. J. Bennett, working in Uganda, believe that it is helpful to divide the food practices in a cultural group into categories based on public health needs for change. They suggest that, before any attempt is made to change practices, they be divided into:

1. Beneficial practices such as breast feeding. These should be supported and promoted in local health teaching.
2. Neutral practices such as massaging the limbs with oil to make the bones strong. These seem to have no significant value nor to be harmful and should be let alone.
3. Unclassifiable practices such as the mother's pre-chewing of foods for her infant. These need further observation and consideration in special groups.
4. Harmful practices such as failure to give young children fish in Malaya where it is the main source of protein but is said by the

people to produce worms. This fourth category should be the basis for "friendly persuasion and convincing demonstration."

Whether the food habits be those of a group in Uganda or a group in the United States, it would probably be wise to make a decision, after careful study, of what particular habits are most in need of change. In 1948 the Philadelphia Child Health Society prepared, for public health workers to use, an exceptionally useful chart. For each of the major cultural groups in the city, they listed typical daily meals with food preferences. They also listed good points about the diet as well as points to emphasize or discuss and to consider in need of changing.

Making Food Available

Many examples of changes in dietary patterns because a food becomes available in a convenient form have already been cited in the quotation from Todhunter on page 119. The extensive use of frozen orange juice today is one illustration. Many of the older generation no doubt still remember the one orange a year in their Christmas stocking. The frozen food industry has made locally produced foods available all over the United States and, in fact, in many other countries of the world. The author was amazed a few years ago to have a common brand of frozen chicken from the United States served to her in a hill village fifty miles out of Accra, Ghana. When production costs, as with frozen foods, decrease so that the average consumer can afford the item, the use of the food often increases.

The story of the Aarey Dairy Project, located some twenty miles from Bombay, India, is worth telling here. One of the startling sights to a stranger in this part of the world was the filthy open sheds for water buffalo which were then used in dairies in this region. It was not difficult for the observer to understand why these animals gave a low yield of milk; they were really pitiful looking creatures. Neither was it difficult to understand why, in 1916, Dr. Lamuel Joshi, who was then the municipal analyst for the city of Bombay, found that samples of Bombay milk contained more bacteria than the sewage water of London. He found many causes, including adulteration, antiquated methods, bad sanitation, ignorance, and greed. So the name "dirty milk" lingered for some decades. For years, however, apparently little was done to clean up this deplorable siutation. In 1940, however, a special campaign to feature the "dirty milk" of Bombay was undertaken when D. N. Khurody reproduced the 1916 statistics in his report on "Marketing Milk in Bombay."

In 1914 there were five to six thousand water buffalo which furnished milk for Bombay. By 1944, this number had increased to thirty-five thousand; but it is said that, with inadequate care and food, these animals became useless after their first lactation.

In 1941, World War II conditions further increased the troubles encountered in the milk industry of India. The price of milk also increased sharply. With the bombing of Calcutta, evacuation from the large cities, including Bombay, took place. Food rationing included food for cattle, and the ban on exporting animals from other provinces to consuming centers such as Bombay made the milk problem more than a municipal one.

Although public milk schemes were then unknown in India, the Civil Supplies Department of the Bombay state government took a great step forward. On August 17, 1944, they introduced the Bombay Subsidized Milk Distribution Scheme. It soon became evident that this subsidy was not the total answer, so in 1945 a group of interested officials created a separate milk department headed by a commissioner. This group acquired eleven hundred acres of land near the village of Aarey and built a dairy plant on it. Milk from the surrounding area was brought into the new dairy. Because, obviously, so few buffalo could do little to supply the milk needed in Bombay, a bold plan was made for housing all the milk-producing water buffalo of the area owned by the farmers in one colony. In 1948 the government of Bombay also took action to remove water buffalo from the streets of Bombay City. They also decided that the processing and distribution should be done by modern methods. Very soon the number of animals increased to twelve, then fifteen, and later seventeen thousand. In 1959 there were, on about thirty-five hundred acres, fifteen thousand water buffalo housed and milked in clean sheds, one thousand to a shed. A modern plant was pasteurizing whole milk and also producing "toned" milk. The fat content of water buffalo milk is around 7.5 percent. For toned milk, powdered nonfat milk and water are added to the water buffalo milk. This milk can be sold for about one-half the price of the whole milk with its natural fat content. In 1962 the imported skim milk powder used for toning milk reached fifty-five hundred tons.

The project combined the efforts of the municipality of Bombay and the state of Bombay with the efforts of international organizations. UNICEF, in 1958, put a large sum of money into the equipment and building for the pasteurization and processing plant. The nonfat powdered milk was being donated largely by the United States and New Zealand. For what UNICEF contributed, the government of Bombay agreed to distribute one and one-half times the original investment in free milk to mothers and children.

Technical assistance from veterinarians and others in animal husbandry was, from the beginning, also partly supplied by outside agencies such as the United States agency now called AID. Early in the formulation of the scheme, it was decided to donate to the farmers veterinary aid and to provide for artificial insemination free of charge. Also from the first, feed was purchased in large quantities and sold to the farmers at cost.

The farmers who now own the water buffalo care for, feed, and milk them. They sell the milk to the city of Bombay in the pasteurization plant just after the water buffalo is milked. At this point the Milk Commission of the city of Bombay controls the handling of the milk and is responsible for its pasteurization and bottling as well as distribution.

The bottled milk is trucked into the city and sold twice daily between 5 and 6 a.m. and around 4 p.m. from nearly one thousand small stations located throughout the city. The author was fortunate, in 1959, to be able to observe from her downtown hotel window long lines of people coming for this milk. At that time, getting on the list to buy this milk was a privilege not usually sacrificed by failure to live up to the regulations. Each customer was required to present a clean bottle each time and was not allowed to miss calling for the milk more than twice.

Within a relatively few years after this Aarey Project Dairy was built, with the additional milk brought in from the surrounding district and processed at this dairy, it was supplying at least some milk daily for approximately one-half the people of Bombay. Another plant was then built, with the hope that the other fifty percent of the people, if they so desired, could be supplied with this clean milk. This new plant (Worli), located just outside of the city of Bombay, was opened in November 1961; during its first year it processed fifty-three million quarts of milk and in 1963 the hourly capacity was doubled. It is reported that from 1959 to 1964 (when the program for low-fat milk had to be suspended because of the shortage of the skim milk powder), there were thirty-six million beneficiaries of this scheme.

The success of this remarkable project resulted from the cooperative efforts of government (the city and state of Bombay), the farmers, and international agencies. It was said in 1959 that the water buffalo came from four states in India, feed from six, operators from all over the country, the pasteurization machinery from the United Kingdom, the milk clarifiers from Sweden, the refrigeration machinery from the United States, and the milk-testing machinery from Switzerland adapting a process which had originated in the brains of the French genius Pasteur. Within recent years, this dairy has come to produce 400,000 pounds of milk per day; it is now one of the largest dairies in the world.

It has become a model for dairies for developing countries all over the world.

The author was told that, because the entire district around this dairy has become more prosperous and because of the demonstration, the surrounding villages have improved all kinds of sanitation. Clean water supplies were installed and housing and food are better. Even beyond these things, more and better schools are in operation. The grounds around the processing plant and the milk bar are so attractive that people spend a holiday there and learn firsthand how to produce clean milk and what it and ice cream made from it can taste like.

A report from UNICEF, dated September 1966, says:

> *. . . the full nutritional value of India's large production of milk has not been utilized because of lack of facilities for collection, processing, and distribution of fluid milk and its products. It has been recognized at the highest levels in India that one of the most valuable forms of international assistance for the improvement of nutrition is help in the development of greater milk production, proper collection, processing, and distribution of low cost milk.*

In 1966, eight milk plants were in operation in India; three were scheduled to begin operation in late 1966 and two in 1967. The objectives of all these were to provide safe, low-cost milk to mothers and children, free or at subsidized prices lower than the regular market price, and also to stimulate milk production.

World milk production, reflecting India's efforts as well as those of other countries, rose from 260 million metric tons per year in the mid-1930's to 339 million metric tons per year by 1960.

In the report by UNICEF, *Children of the Developing Countries,* it is said:

> *The rapid growth of dairying and industrial milk processing in Europe, North America, Australia, and New Zealand in the first third of the present century probably did more to improve the nutritional status of children and mothers in these countries than any other single development in the field of food and nutrition.*

There are probably few stories as thrilling as this, where making a needed food available has benefited so many people. It must be pointed out that most of the peoples of India like and drink milk glady when it is available. Furthermore, it represents almost the only source of animal protein in the family diets.

STUDY QUESTIONS

1. How are the problems of space exploration similar to other explorations in history and how do they differ?
2. Of what will our foods of the future consist? How do you think people will react to a new type of food fare?
3. What special purposes are served by Multi-Purpose Food (MPF)?
4. Are there other projects currently in operation similar to the Nebraska Freedom Meal project?
5. Where has fish-protein concentrate been used successfully in improving the diet of school children? What other uses are planned?

TOPICS FOR INDIVIDUAL INVESTIGATION

1. Plan in detail a program to improve the food habits of a particular group of people using the Willerman-Lewin method.

2. Find out from various agencies, including the National Aeronautics and Space Administration, exactly what foods are being planned for lunar flights. Explain why each food is to be used.

3. Discuss what foods from the sea are not currently being used, but which scientists expect to have used in the future. Find out what obstacles must be overcome to make better use of these foods.

4. Incaparina is one high-protein food made from products indigenous to the country where it is used. Investigate what similar products are used in the Union of South Africa, Malaysia, and the Near East.

5. Explain in what ways fish-protein concentrate can be added to already familiar foods. Discuss the deterrents to this use telling what are they and how they can be handled.

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9

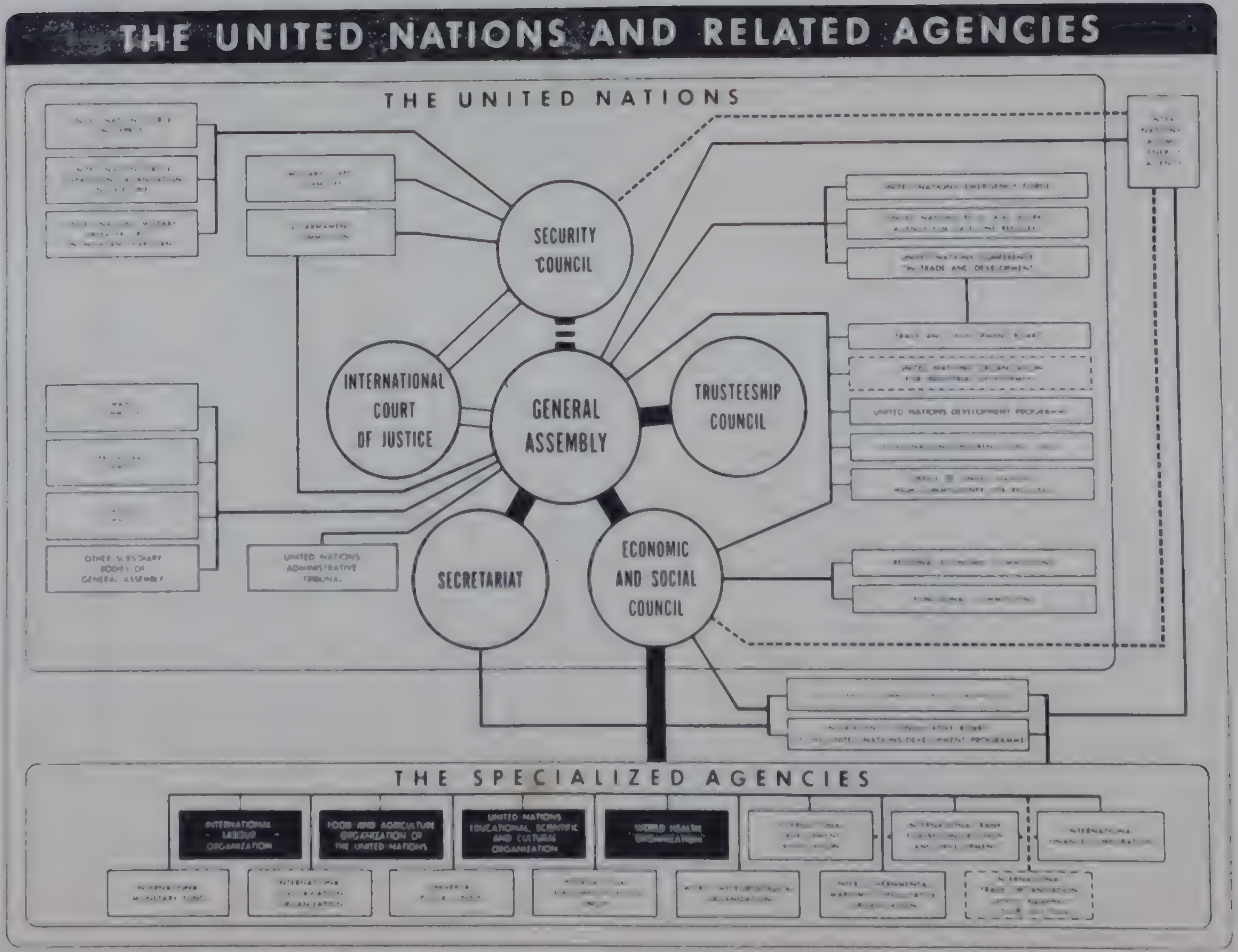
PROGRAMS TO IMPROVE NUTRITION

When historian Arthur Toynbee said that the twentieth century will probably be remembered most because it was the first time in recorded history when man dared to use his knowledge to benefit all mankind, he could have been talking about the international as well as national programs to relieve hunger and malnutrition. Although many of these programs have their roots in ideas and proposals from previous centuries, the united efforts of the twentieth century have brought more immediate and more far-reaching results.

PROGRAMS OF INTERNATIONAL ORGANIZATIONS

FAO: Food and Agriculture Organization

Future historians looking back on this century will have to record the tremendous scientific advances and ventures into outer space as outstanding events. They will also have to give credit to this century as


THE UNITED NATIONS AND RELATED AGENCIES
THE UNITED NATIONS
SECURITY COUNCIL
INTERNATIONAL COURT OF JUSTICE
GENERAL ASSEMBLY
TRUSTEESHIP COUNCIL
SECRETARIAT
ECONOMIC AND SOCIAL COUNCIL
UNITED NATIONS DEVELOPMENT PROGRAMME
UNITED NATIONS ADMINISTRATIVE TRIBUNAL
OTHER SUBSIDIARY BODIES OF GENERAL ASSEMBLY
THE SPECIALIZED AGENCIES
INTERNATIONAL LABOUR ORGANIZATION
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION
WORLD HEALTH ORGANIZATION

The United Nations system—an organizational chart. (Courtesy of the United Nations and related agencies) the one when man first achieved a worldwide program of international cooperative effort for the improvement of the nutrition of all people everywhere. FAO, with its dramatic design and Latin motto "let there be bread," stands as the symbol for the Food and Agriculture Organization of the United Nations. This is the first agency of the United Nations that was established; it has the major responsibility for helping mankind the world over to get more and better food. FAO was established in 1945, but FAO did not just happen on that date. Its purpose and achievements are significant, but an understanding of events leading up to the establishment of FAO are essential if we are to understand man's progress toward developing a genuine concern for his fellowman's well being. The story that is the background for FAO had its beginnings some fifty years ago.

For many years some professional organizations have held international meetings and have demonstrated that people of different nationalities could talk together on professional subjects of common interest. An International Institute of Agriculture (IIA) was organized in 1905 mainly through the efforts of David Lubin, a California businessman and farmer. He believed that by collection and dissemination of international statistics about agricultural products, the farmers and food producers in various countries could be helped to obtain the best markets for their products. He gained the interest of the King of Italy who provided housing for the Institute in Rome. However, IIA was concerned with food as a trade commodity rather than in relation to the health and welfare of people.

Wars have brought hunger, famine, death, and destruction to peoples and nations from earliest times, but in this century war has brought forth in many nations the genuine desire to work together for the common good. As a result of World War I (1914–1918), two international organizations were formed: the International Labor Organization (ILO) and the League of Nations, both with headquarters at Geneva, Switzerland. ILO was organized to deal with problems related to labor such as hours, wages, unemployment, child labor, old age pensions, and sickness benefits. However, in 1935, ILO did concern itself with the nutrition of workers and in 1936 published the report of a study, "Workers Nutrition and Social Policy."

With the establishment of the League of Nations there was hope that at last a new world order would begin. But political problems eventually became insurmountable for the League; it was handicapped because the United States was not a member. Though the League failed, it did have many successes in the area of social and economic problems, particularly in health and nutrition.

In the Covenant of the League of Nations it was stated that the League was "To endeavour to take steps in matters of international concern for the prevention and control of disease." A health organization was formed within the League for this purpose, and it was in this health section that the first international programs of food and nutrition had their beginning. In 1925 the Yugoslav delegation to the League requested a study of methods to be recommended in the interests of public health for the regulation of the manufacture and of the sale of food products. But it was not until ten years later that there was any widespread recognition of the need for nutrition studies. In 1935 a report, "Nutrition and Public Health," was published by Dr. Etienne Burnet and Dr. Wallace Aykroyd in the Quarterly Bulletin of the Health Organization. When the Assembly of the League met in September that year, this report was the basis of discussion. Stanley Bruce of Australia delivered a great speech in which he used the phrase "to marry health and agriculture" and went on to say, "by so doing, make a great step in the improvement of national health and, at the same time, an appreciable contribution to the solution of the agricultural problem." Bruce captured the interest and imagination of those assembled, and a resolution was passed to continue the nutrition work of the health committee and to bring a general report to the next meeting of the assembly.

In 1937 the League published a report, "The Relation of Nutrition to Health, Agriculture and Economic Policy," which became a best seller and inspired many governments to take practical steps to improve the diets of their people. Then World War II came, and the League of Nations was lost; but though it failed in its major goal, there were many solid achievements. And its international work in health and nutrition survived but in a new and different organization.

Preliminary Meeting

While World War II was still in progress, an event of profound significance in the history of mankind took place. This was a conference called by President Franklin D. Roosevelt and attended by representatives of forty-four nations. The place of meeting was Hot Springs, Virginia, and the dates were May 18 to June 3, 1943. It was a meeting solely for the purpose of working together to secure lasting peace when the war was ended. Those attending the conference believed this could be achieved by raising the standards of living of the two-thirds of the world's population that was malnourished and in want.

Historic events like this do not just suddenly happen. What caused Franklin D. Roosevelt to call this conference at Hot Springs? The answer lies to a large extent in the influence of one man, Frank McDougall. This man was in Washington, D. C., in 1942 for discussions on an international wheat agreement; while there, he drafted a memorandum on a United Nation's Program for Freedom from Want of Food. This memorandum was not a sudden thought but was based on a lifetime of experience and of knowledge gained as the Australian delegate to the League of Nations (1929–1939) and a member of the nutrition committee of the League. McDougall had worked with Stanley Bruce; in the memorandum he wrote in 1942, McDougall outlined proposals which would make Bruce's marriage of health and agriculture a reality.

> *Freedom from want of food must be given high priority in the actions taken to fulfill the pledges of the United Nations. For not only is food the most essential of human needs but the production of food is the principal economic activity of man . . . one of our most urgent immediate problems is the inability of the lower-income groups to buy sufficient food to maintain good health. Its solution will depend upon economic and social policies designed to increase purchasing power and to reduce the costs of production and distribution. . . . The need is to establish at once a United Nations Organization. . . . A Technical Commission on Food and Agriculture should formulate action programs designed to assist the nations to achieve freedom from want of food. . . . The necessity for immediate action cannot be over-emphasized. We must act now if we are to avoid the risk of losing the peace.*

Mrs. Eleanor Roosevelt saw this memorandum and realized that it incorporated some of the same ideas as given by President Roosevelt in his statement a year earlier of the Four Freedoms. She arranged for McDougall to meet President Roosevelt; the outcome was that the President of the United States convened the Hot Springs Conference in May 1943.

The conference recommended that the nations represented there should establish a permanent organization in the field of food and agriculture and that an Interim Commission be appointed to work out plans for such an organization. Frank McDougall was a member of the Interim Commission and helped to draw up the Constitution of FAO. (He continued to work with FAO in advisory capacities almost to the day of his death in 1958; the McDougall Memorial Lecture was instituted by the Council of FAO, Rome, 1958, to commemorate his work.)

FAO Established

The next step, following the work of the Interim Commission after the Hot Springs Conference, was taken in October 1945 when delegates from forty-two countries met in Quebec, Canada. They ratified the constitution which formally established the Food and Agriculture Organization of the United Nations. The preamble to the Constitution of FAO states:

> *The nations accepting this Constitution, being determined to promote the common welfare by furthering separate and collective action on their part for the purposes of:*
>
> *Raising levels of nutrition and standards of living of the peoples under their respective jurisdictions,*
>
> *Securing improvements in the efficiency of the production and distribution of all food and agricultural products,*
>
> *Bettering the conditions of rural populations,*
>
> *And thus contributing toward an expanding world economy,*
>
> *Hereby established the Food and Agriculture Organization of the United Nations.*

FAO is an autonomous independent organization which is a member of the family of specialized agencies of the United Nations. It has close ties with other specialized agencies, especially with WHO with which it has a joint committee on nutrition, with UNICEF, and with UNESCO. The member countries of FAO have pledged themselves to improve world agriculture, forestry, and fisheries through the pooling of their knowledge, efforts, and resources. Thus they are making a basic attack on the problem of improving health through increased food production and improved quality and nutritive value of food.

Each member government supports the regular activities of FAO by paying into the budget a contribution proportionate to its national income. All members of FAO meet in conference every other year; the world food and agricultural situation is reviewed, and policies and activities are reexamined and changed as necessary. Each member country has one vote and elects the Director-General and a Council of twenty-seven members which meets one to three times a year. The present Director-General, the fifth in the history of FAO, is Mr. Addeke H. Boerma of the Netherlands.

It takes more than the stroke of pen and signatures on a document to make words become reality. Especially is this true when the desired reality is action and change in the lives of people. It takes time, patience, hard work, flexibility, willingness to adjust to the point of view of others, and a determination to overcome obstacles.

Of these ingredients FAO needed a liberal supply. There were barriers, disappointments, frustrations, and conflicting ideas, but the purpose and goal were always kept in sight. There have been some re-

Children in Costa Rica learn how to grow vegetables in school gardens with help from the Food and Agriculture Organization. (Courtesy of United Nations)

markable achievements. At the end of the first ten years of its work, FAO again met in Quebec to celebrate its historic founding and review accomplishments. That year, 1955, two books were published giving authoritative and exciting accounts of the work of FAO: *So Bold an Aim* by P. L. Yates for FAO, and *The Story of FAO* by Gove Hambidge. You will be well repaid by perusal of these books, but here we can give only a few examples of what FAO had done up to that time. With a budget that was at first very limited, FAO carried on two main lines of work:

1. Gather technical and economic information on food and make this available to all countries.
2. Advise and help governments so requesting on action programs for food and agricultural development.

Some agricultural methods need to be changed. (Courtesy of Food and Agriculture Organization)

Basic information on the available food supplies in various countries is an essential starting point.

In 1946 FAO published a World Food Survey; it published a second survey in 1952 and a third in 1963. Studies were published giving the facts about some of the most urgent technical problems, such as conserving soil and preventing waste of food in storage, and giving suggestions for coping with these problems. Also in 1946 a mission was sent to Greece to study the whole economy of the ocuntry and draw up a twenty-five-year development program for the government. The following year another mission studied problems of agriculture in Poland and made practical recommendations for increasing that country's food production. Similar missions went to Thailand, Venezuela, and other countries. Schools, conferences, and committee meetings were held in several countries to bring professional workers up to date on problems such as plant breeding, food storage, locust control, and combating diseases of animals. An International Rice Commission, based in Bangkok, worked with Asian countries developing more productive strains of rice. Fisheries Councils for the Indo-Pacific, the Mediterranean, and Latin American areas undertook many practical projects for increasing fish supplies and distribution. Regional meetings on education in nutrition, energy requirements, and child nutrition, and meetings to train home economists and extension workers were held in many regions.

Simple practical projects were also undertaken such as helping farmers in Afghanistan learn to use hoes, spades, and forks, and to replace the ancient sickles with scythes.

The FAO catalog of publications lists many items; along with the World Food Surveys already mentioned are statistical bulletins and yearbooks, reports of conferences and expert committees, popular pamphlets, and leaflets.

FFHC: Freedom From Hunger Campaign

This campaign was launched by FAO on July 1, 1960, to try to bring more people in all countries of the world to a closer realization of the problems of world hunger and an understanding that by concerted effort hunger can be overcome. The affluent nations cannot feed the hungry millions in the world. Starvation and hunger can be prevented only if the less-developed nations can increase their own food production. The basis of the plan is to help hungry and malnourished people to help themselves. This is to be achieved by:

1. Teaching farmers new skills and teaching mothers better ways of feeding their families. It is not easy to get farmers and their families to change from the old traditional ways that have been used for centuries.
2. Demonstrating results that can be obtained through use of fertilizers, better seeds, crop protection, irrigation, soil conservation, improved breeds and care of animals, improved methods of fishing and use of fish ponds, protective storage of foods, and international cooperation.
3. Helping to provide teachers and field workers, training programs, fellowships for study, seeds, tools, and equipment.
4. Persuading people individually or as groups, communities, organizations, and governments to cooperate and to act at once in the ways just described.

That was July 1960. The plan was supported by the United Nations and its specialized agencies. Rapidly, Freedom from Hunger Campaign (FFHC) committees were set up in eighty countries with support from

This Tasmanian cannot feed his family properly under these conditions of primitive agriculture. (Courtesy of Food and Agriculture Organization)

over one hundred and fifty voluntary societies. FAO, until this time, depended on the joint efforts of the governments of the nations which made up its membership, but FFHC tries to reach the people and get action from them.

Each country sets up its own FFHC committee and makes its own plans of action. All try to get the interest and active support not only from government but also from nongovernmental organizations (NGO's) such as social and professional groups, industrial and commercial concerns, church and religious organizations, community groups, and private citizens. FFHC serves as a focal point for these joint endeavors. In the United States a Freedom from Hunger Foundation was established with former President Harry S Truman as honorary chairman. The first cash donation to this Foundation came from the people of the Virgin Islands.

Much has been done in many countries by the national committees.

There have been three broad areas of work:

1. Information and education to help people know and understand the world problems of food and hunger.
2. Research to find needs and ways of meeting them.
3. Action programs.

FAO and other organizations of the United Nations published a series of Basic Studies Booklets covering such subjects as hunger and social policy, malnutrition and disease, nutrition and working efficiency, education and training in nutrition, and population and food supplies. These provide factual data and information as a basis for action.

FFHC was planned as a five-year campaign; at the midway point in March 1963, a World Freedom From Hunger Campaign was designated and supported by one hundred and fifty countries and territories. FAO invited all governments to issue at that time postage stamps that would be commemorative of the Campaign, and there was a worldwide response. This author has in her collection commemorative stamps from one hundred and thirty-seven countries and islands; many are beautiful in design and color and almost all use in the design of heads of wheat which are the main features of the FFHC emblem. These stamps have gone from country to country everywhere carrying the message of the world's food needs.

Also in 1963, in June, the first World Food Congress was held in Washington, D.C.; a second such congress is planned for 1968. FFHC has now been extended until at least 1970.

One story from the November-December 1966 *Freedom from Hunger* magazine will serve to illustrate the hundreds of ways that people in more fortunate circumstances are helping those in need. Casper Baldwin lives in Tanzania on the farm of a few acres belonging to his parents. His father never earned more than two dollars a month in his whole life. Casper spent nine years in a leprosarium but is now completely cured. He did some farming while at the leprosarium and decided he wanted to be a farmer. Some cured patients were to be sent to farm-training centers. Casper heard about it, applied for training, and was accepted. He went with twenty-three expatients to Urambo, a big flat farm on cleared bushland where a center had been built with some $225,000 from the people of Devon, England, donated under FFHC. Here Casper began a two-week course in gardening, poultry keeping, animal husbandry, and rabbit and pigeon raising. All he learned was feasible for the poverty stricken Tanzanian farmer; at Urambo he saw poultry houses made of saplings plastered with mud for walls; he saw vegetable gardens struggling in the heat and drought the same as his own garden. He also saw what was a real possibility for him. And so he made plans for his future; this is almost unheard of in a land where farmers consider planning ahead even for one year to be a blatant tempting of fate.

Casper Baldwin planned for three stages of development on his farm. Stage one would be to sell a few of his father's eighty goats to buy a cow as the start of a small herd. He and his wife would plant a vegetable garden, half an acre at first. He learned at Urambo that with proper care he could get three garden crops a year. He would also start some poultry and hoped in the first year to earn six dollars a month. Stage two would also last a year, and he planned to expand his garden and raise his own poultry feed, plant fruit trees around his house as a windbreak, and raise a few pigeons for meat. His income should then reach twelve dollars a month from sale of garden produce, eggs, poultry, and milk. (The principal of Urambo Center believes he can do this.) Stage three would be an expansion of all the activities of the first two stages, bringing an income of twenty dollars a month. (The average farmer in his country earns only five dollars a month.) Then, Casper Baldwin said, if he was successful that far, he would borrow money and go into bigger scale farming.

Urambo Center gave Casper Baldwin his training, and the Devon, England, FFHC committee that started the center continues to collect money for running expenses and supplies for the center.

Much is being done in the world to increase food production; but as of the end of 1966, there are some statistics that must be faced realistically, and they are as follows. By the end of this century the world's population is expected to double. Much of this increase will be in the less developed countries. To feed the extra population of the next thirty-four years at present levels, food production will have to be doubled; to *improve* nutrition in the developing regions, world food supplies will have to be trebled by the end of the century. A year of bad harvests, due to drought or other causes, can be disastrous. Last year, mainly because of drought, food production in Africa, Latin America, and the Far East (excluding China mainland) declined by an estimated two percent in total and by four to five percent on a per caput basis.

The average age of the world population is under thirty years, and between fifty-five and sixty percent of the population of the developing countries are under twenty years of age, according to FAO.

It is logical, therefore, and, in fact, it is essential to seek the cooperation of youth in the struggle to increase food production. This is what FAO's Director-General, Dr. Sen, did as part of FFHC. He created the Young World Appeal.

YWA: Young World Appeal

In June 1964, Dr. Sen proposed to member governments of FAO, national FFHC committees, and nongovernment organizations a Young World Appeal to involve youth in economic and social developments in the world and to encourage society as a whole to recognize the importance of training and preparing young people for the future.

In February 1965, the Appeal was presented at the seventh session of the FFHC/NGO Advisory Committee meeting in Geneva. The Appeal plan was accepted by these representatives of religious groups, trade unions, youth and student organizations, education groups, and businessmen and businesswomen associations; they insisted that the Appeal should be the start of a major continuing contribution by young people to the fight against hunger.

In October 1965, in Rome, at the 20th Anniversary meeting of FAO, a Young World Assembly was held. It was attended by forty-four young people from thirty-two countries and they issued a Manifesto calling on youth of the world to work together to eliminate hunger. An international emblem was adopted. The Manifesto, which has since been translated into more than thirty languages and widely distributed, appears below.

MANIFESTO: MAN'S RIGHT TO FREEDOM FROM HUNGER

More than half the human race is either undernourished or malnourished; yet about 150 billion dollars were spent on armaments in 1962, while the sum spent on development was an insignificant proportion of it. When we consider that in the twentieth century, one child out of three is born without any chance of living a normal life, we are forced to conclude that our civilization is mutilating its human resources and reducing its chances of progress. The situation is getting worse because the population is increasing rapidly and food production is not keeping pace with it. The means are, nevertheless, at hand to meet this challenge and if they are used properly, the hope of a world free from the miseries of hunger can now be realized. Is mankind alive to this danger and prepared to meet it?

It is intolerable that the vast reservoir of knowledge and *wealth which exists in the world is hardly being used for improving the lot of the many who are desperately in need of it. Of the several wants of man, food is primary. Hunger and malnutrition can impede the progress of a nation in every other sphere.*

No development can be lasting which is not based on a mobilization of national resources. But external aid is indispensable initially to guide and supplement these efforts. The impediments to improvement are social and economic rather than scientific and the supply of know-how and capital and the provision of facilities for education are the best means of ensuring an evolution towards a better life. The problems are complex, vast and urgent and can be solved only if national efforts are supported by international assistance and cooperation. In this connection, trade agreements should aim to preserve the dignity and independence of developing countries by enabling them to sell their products in the markets of the world. Cooperation by all economically advanced nations, both capitalist and communist, in the conquest of hunger and poverty, the common enemy of all mankind, may indeed breed sufficient mutual trust and confidence to assist progress towards that other of the fundamental freedoms, namely, freedom from the fear of war.

The Freedom from Hunger Campaign seeks to stimulate national and international effort. It aims to inform the Governments and educate the people so as to make the best use of the total resources of all nations.

We desire to state with all the emphasis at our command that freedom from hunger is man's first fundamental right. In order to achieve this, we suggest urgent and adequate national and international effort in which the Governments and the peoples are associated. More particularly, we desire to draw attention to the colossal waste of resources in the piling up of more and new forms of armaments and the immense assistance to the Campaign against Hunger that even a partial diversion of these funds could achieve. We feel that international action for abolishing hunger will reduce tension and improve human relationships by bringing out the best instead of the worst in man.

Done at Rome, 14 March 1963

In March 1966, a Young World Promotion Group, appointed to assist Dr. Sen in working out the future lines of the Appeal, met and made suggestions and plans for future action. This group met again in January 1967.

Young people have not waited. Action has been immediate and productive in many countries throughout the world. Information about Young World Appeal has been disseminated by young people themselves through essay and poster contests, seminars, conferences, exhibits, publications in youth magazines and newsletters, preparation and distribution of leaflets, and handbooks. They have gone further than this, however. A few examples are given here; they are illustrative of actions of young people in many countries—in developing countries as well as in the developed ones.

- Young people of Iceland started to raise $26,250 for modernizing fishing boats in Madagascar. But they collected so much more that they are providing a home economics teacher and equipment and supplies to teach home crafts to women in Morocco and are supporting a project on inland fishing in Nigeria.
- New Zealand youth raised $36,400 to set up five family-size dairy farms in Keral State, India, and to bring farmers from Korea to New Zealand to learn about dairy farming.
- In Italy the YMCA collected $12,704 to run a poultry project in South India for three years.
- Agricultural students and their dairy science professors at Pennsylvania State University collected agricultural textbooks and sets of technical journals valued at $3,300; and these were sent to training institutes in Kenya.
- The government of Ghana isued a Youth Against Hunger postage stamp, the first of its kind.
- In Ceylon, school children gave of their labor; if rice fields could be weeded, the rice crop production could be increased twenty percent. And so last year 620,000 school children of Ceylon each contributed one day's work, and 24,000 acres of young rice were weeded during the season. The aim for the next year is ten days work from each child.

Many other successful projects are described by FAO. One private industrial company financed a special youth project under FFHC; it is described below.

YWFD: Young World Food and Development

This was a special project as part of the Young World Appeal. The funds were donated by Massey-Ferguson Limited of Toronto, Canada, as a contribution to the Freedom from Hunger Campaign and in honor of this company's home country, Canada, on the occasion of its Centennial Year celebrations. The Young World Food and Development Project focused for one year, 1966–1967, on plans for mobilizing out-of-school rural youth around the world in self-help activities. The goal was to provide programs in developing countries that would contribute to food production and, at the same time, help rural youth of these countries develop organization and leadership skills, literacy, interest in science and education, and a spirit of self-help and self-confidence. The Massey-Ferguson contribution supported six preparatory regional seminars in Asia and the Far East, Africa, Latin America, the Near East, Europe, and North America. At these seminars rural youth program leaders and officials of government agenices and private organizations met together to exchange experiences that have proved successful, to find desirable programs, and to plan and institute action to achieve their goals. The climax of the YWFD project was a world conference in Toronto, Canada, in September 1967. At this conference the findings of the preparatory regional seminars were shared and plans made for a worldwide program of action.

Through this project FAO encouraged its member countries and interested organizations to combine their efforts on such rural youth programs in developing countries. This will double the program's size scope and the number of youth reached each five years over the next fifteen years.

To the imaginative reader this listing of the programs and some achievements of FAO, FFHC, YWA, and YWFD must bring endless mental pictures of what is happening in homes, on farms, in communities, cities, and regions of the world. Even the most hard-headed realist cannot fail to see that things are happening, and that today there is hope where yesterday there was despair for scores of thousands of people in less developed countries of the world. Such a statement as this does not mean that we are blind to the failures, the difficulties, and the barriers to success (and one of the greatest handicaps is the shortage of trained workers and technicians). Nor does it mean that there is any possibility of a worldwide change tomorrow. To provide enough food for the world's people is a long slow process which, according to Dr. Sen, may take generations and decades of continued effort of FAO and other specialized agencies of the United Nations as well as the fullest cooperation of all people everywhere. But in a world where man can walk in space, surely "early problems" can be solved.

UNICEF: United Nations International Children's Fund

It is estimated that of the 1200 million children in the world today, 900 million are born into countries still struggling with overpowering problems of sickness, illiteracy, and poverty. This is not a new situation, but the giving way of the old fatalistic attitudes toward poverty and ignorance to new hopes and efforts is new. Now parents in Asia, Africa, and Central America dare hope for the advantages for their children which those in the more privileged countries have. These stirrings of hope have been aided by a new international consciousness and awareness of these needs. UNICEF, the only international agency whose sole purpose is to be concerned with the needs of children, has accomplished much in its twenty years of existence to promote this new hope in families all over the world.

In February 1946, President Truman appointed former President Herbert Hoover to head a survey mission to study the needs of children in war-torn European countries. Following the completion of this survey, Mr. Hoover, supported by other respected public officials, recommended that a special body be created within the United Nations to meet the emergency needs of these European children suffering from the ravages of the recent war. In mid-December of the same year, the United Nations International Children's Emergency Fund (UNICEF) was established by the United Nations General Assembly.

Although UNICEF is a part of the United Nations, it has had a semiautonomous status. An Executive Board was appointed by the United Nations. Secretary General Trygve Lie, in consultation with this Executive Board, appointed as the first Executive-Director of UNICEF Maurice Pate, an American and an associate in his previous humanitarian activities of Mr. Hoover. Dr. Walter Judd, the well-known congressman from Minnesota, proposed that an initial fifteen million dollars be contributed by the United States to get this work started. At the outset, the American contributions were more than seventy percent of the total.

In its first three years of existence, the resources of the Fund were devoted largely to bringing food, medical supplies, and clothing, on an emergency basis, to the children of fourteen war-ravaged countries of Europe and China. During the years from 1948 to 1952, some emergency relief was also furnished to refugee mothers and children of Palestine.

When it was evident that Europe was recovering, the needs of children in the economically underdeveloped countries created a new demand on the Fund. It has been pointed out that these so-called developing countries are and were simply developing much less rapidly than the economically advanced countries. In 1963 the combined income of the approximately one hundred and twenty developing countries was in the area of one-fifth that of the more advantaged countries. Many families had less than one hundred dollars total yearly cash income. It is well known that where the minimum measure of "freedom from want" is not satisfied, children suffer most.

In 1950, therefore, the General Assembly extended the life of the Fund by three years and directed a shift in emphasis from emergency measures to long-term programs in the developing countries. At the end of these three years, UNICEF established its worth and the General Assembly voted to continue the agency indefinitely. At this time the name was shortened to the United Nations International Children's Fund, but the well-known initials of UNICEF were retained.

UNICEF is governed by an Executive Board which meets regularly once a year to set policy, consider requests, allocate funds, evaluate results, and establish the annual administrative budget of the Fund. The actual day-to-day operation is the responsibility of the Executive-Director. Maurice Pate, the first Executive-Director, continued to give outstanding service until his death in 1965. At that time another American, Henry Richardson Labouisse, was appointed. At the present time UNICEF has a staff of nearly seven hundred persons located in some thirty-eight regional areas and country offices throughout the world.

During 1966 the Executive Board approved program assistance totalling 29.6 million dollars, a further 5.6 million dollars for operational services in connection with the development implantation of projects, and 3.1 million dollars for other administrative services in the last half of 1966 and the first half of 1967.

UNICEF is supported entirely by voluntary contributions from governments, from organizations, and from individuals. In 1966 the estimated income was 34.5 million dollars of which approximately seventy-seven percent, or 26.7 million dollars, came from governments of one hundred and seventeen countries. The United States government contributed 12 million dollars or forty-four percent of the total governmental contribution. The contributions of private organizations and individuals, though they do not make up a major part of the total, have been tremendously important to UNICEF. In recent years, over three million American children in nearly fourteen thousand communities in all fifty states, through locally sponsored Halloween collection programs, have brought in over two million dollars a year. This program has been very popular because it allows children to have their own fun while contributing to the world's needy children.

The story of UNICEF Christmas cards is also a heartwarming one. In 1949 Jitka Samkova, a seven-year-old girl living in a village in Bohemia, sent her own painting to UNICEF as a thank you for the postwar help given to the children of her village. Many of us remember her joyful picture with the wreath at the top of a maypole which she said was to show that the line of children being helped was endless. UNICEF used her drawing, and in 1950 sold 130,000 Christmas cards with the drawing on them. Since then, 280 million Christmas and greeting cards have been sold, earning for the Fund some $16,700,000. This project has shown remarkable growth; the number of countries participating increased from eleven in 1950 to over one hundred and ten in 1966. The net income rose from $4,200 for the first year of the campaign to over 3.25 million dollars in the 1966 campaign.

Policies

UNICEF has certain basic policies. First of all, the countries receiving UNICEF aid must agree to use this aid equitably and efficiently on the basis of need without discrimination because of color, creed, nationality, or political belief. Once UNICEF's aid is discontinued for a particular project, each government continues it on a permanent basis. In fact, as is illustrated later in this chapter, one of the primary considerations before the UNICEF Executive Board approves a project is that it can and will become a permanent program under the government requesting the aid. So, as is said in the 1963 UNICEF report, the Fund "uses its resources to prepare the way for larger programs under national or international auspices." To encourage government interest and commitments from the very outset, UNICEF requires that matching funds be contributed by the benefiting country. At the present time these matching funds are two and one-half times the UNICEF contribution.

UNICEF operates no projects of its own within countries but instead always lives up to its goal of encouraging and stimulating "local efforts by giving them international help which can be used as a lever for mobilizing local resources on behalf of children."

UNICEF aid to benefit children so far has been given in the fields of health, nutrition, and social welfare. Although, in its early years of existence, most of the aid was given to projects in health and nutrition, today the base of operation is broader; attempts are made to assist governments to meet any of the needs of children which the particular country considers to be of high priority and for which practical, effective action is possible. The original purposes of UNICEF were concerned with the right of the child for survival, and this led to the emphasis at first on meeting emergency food and health needs. Maternal and child health services, as will be explained later, received major attention. The eradication of disease played a major role in the effort, with special attention being given to such diseases as malaria, tuberculosis, yaws, leprosy, and trachoma, all of which take a high toll among children.

Nutrition Programs

Around 1955, UNICEF, in partnership with FAO, and WHO, along with various regional, governmental, and private organizations, undertook a united and expanded effort to combat protein-malnutrition in children in areas where milk was not sufficiently available. Later in 1957, UNICEF, in cooperation with FAO and other technical United Nations agencies, set up what was called the "Expanded Nutrition Program."

This program specifically has done such things as:

1. Promoted nutritional surveys to establish facts on which to base practical programs.
2. Given emphasis to local production and consumption of locally produced protective foods.
3. Furnished garden tools, seeds, and equipment for raising poultry and small animals. Under this effort, projects for ponds to raise fish have also received help.
4. Promoted related nutrition education to help all of these programs reach mothers in order to get improvement of diets in the especially vulnerable post-training and preschool children.
5. Trained personnel to promote this nutrition education.
6. Improved primary education in health, nutrition, and home economics by promoting education of teachers to improve school-feeding practices. School gardens and raising of small animals were promoted when teachers were trained in this way.

In 1967 the Expanded Nutrition Program was renamed the Applied Nutrition Program. In all, UNICEF has given assistance to fifty-six projects in this category.

In 1959 UNICEF took another step closely related to the 1957 program for the promotion of nutrition; it approved projects which would improve primary education through teacher training in subjects such as health, nutrition, home economics, school-feeding programs, and school gardening.

In general, UNICEF assistance in nutrition falls under four headings:

1. Supplementary child feeding, chiefly in the form of powdered milk or other high-protein products and vitamins.
2. Milk conservation in the form of general dairy and milk-drying equipment.
3. Development of new high-protein foods from various high-protein vegetable sources such as soy products and peanuts, cotton seeds, and fish.
4. Stimulation of rural self-help activities so that families can make the best use of locally available or potential protective food resources—"applied nutrition."

Social Welfare Programs

Those who work in programs to improve the nutrition of a group find that what people eat or do not eat cannot be separated from the total environment of the group. The development of social welfare programs has thus become a necessity in the total UNICEF effort. In 1966 1.2 million dollars were allocated to such projects, the primary objective of which was the keeping of families together to promote the good care (including, of course, feeding) of children.

UNICEF recognizes that a program can only be self-sustaining if the rising generation is given the needed skills and attitudes. Therefore, UNICEF has, in partnership with UNESCO (the United Nation agency primarily responsible for education), embarked on a program to promote education. Thus children will be helped to prepare for useful lives once they have been saved from malnutrition and childhood diseases.

UNICEF has always, in addition to giving general help to countries in planning projects, furnished equipment and supplies needed to make a project viable. It also has provided stipends for the training of and, in some cases for an initial period, the salaries of key persons in training schemes. About one-third of UNICEF aid is currently going to the training of national personnel. Other international agencies provide technical advice. In all of these programs, UNICEF has worked cooperatively with WHO, FAO, UNESCO, ILO, and the United Nations Bureau of Social Affairs both on specific projects and general policies for giving aid. Close cooperation among these organizations is thus achieved.

Special Programs

An Italian child once explained the word UNICEF as the American word for cow. Undoubtedly, to many mothers and children all over the

NONFAT
DRY MILK
DONATED BY
THE PEOPLE
OF THE
TES

Milk from the Food for Peace Program for a Chilean youngster. (Courtesy of Agency for International Development)

world, the donations of dry skim milk made by UNICEF have spelled at least some relief from hunger and malnutrition. Dry skim milk was given to the children of Europe in the early post-war relief program. The author remembers discussing with the first medical director of that emergency feeding program the probable reactions of those children to this milk. School feeding in Europe was one of the first ways of reaching children. It was early decided, however, that UNICEF should expand its operation to include the world. For this, largescale complete feeding programs were an impossibility. The use of dry skim milk as a supplement was even then recognized as one way of improving children's diets because it is an excellent source of both protein and calcium.

In 1953, because the United States had a surplus of skim milk powder, UNICEF was able to buy it at a nominal price. Later in 1958 and in 1959 the Canadian government also made some dry milk powder available. Beginning in 1954, dry milk powder was available free at American ports for the UNICEF overseas child-feeding programs. The shipping charges averaged from two to two and a half cents per pound. In three years, beginning in 1957, UNICEF shipped one hundred million pounds of this milk annually; it is said that in 1959, five million children in sixty-two countries were receiving daily rations of it. It was distributed in some twenty-five thousand schools and in over twenty-three thousand health centers, with the schools reaching twice as many individuals as did the centers. The consultants, making an evaluation, felt that both programs had, however, made a substantial contribution toward the improvement of nutrition of the world's children. Several other recommendations came as a result of these evaluations. It was evident that preschool children who received this milk through the health centers needed it even more than children of school ages. The study showed also that nutrition education should be given as an integral part of the distribution schemes. It also became apparent that these feeding schemes had created a demand for locally produced milk and, therefore, there was a need for aid for milk drying on a local basis.

Because various factors reduced the production of milk in the United States and in Canada in the last few months of 1959, there developed uncertainty about the quantity of dry milk powder which would be available. At this time it was necessary for the UNICEF Board to agree to furnish the milk to only vulnerable groups. It became even more clear that efforts had to be expended toward helping countries solve their own milk problems. Thus aid was given to numerous government-subsidized projects such as Anand Project in India described on pages 254–257, as well as to projects promoting the use of fat-reduced milk or "toned" milk. The whole problem was even more clearly seen at this time as beyond the range of the assistance which UNICEF could give; the major problems would have to be solved by the countries themselves with technical assistance from FAO and with help in milk hygiene from WHO. By the end of 1965, UNICEF had aided milk-conservation programs in thirty-eight countries, giving major equipment for thirty-four milk-drying plants and sixty-four fluid dairies and auxiliary equipment to another ninety-two dairies. Also included was training in dairying methods and in quality milk control.

In spite of all of these efforts, however, it was evident that neither donations of dry skim milk nor the promotion of milk schemes in many countries could solve the problem of making available sufficient protein-rich foods, especially foods needed by pregnant and lactating women and growing infants and children. As a result the joint effort of UNICEF, FAO, WHO, and the Rockefeller Foundation to produce and distribute new protein-rich food supplements (described on pages 243–246) came into being.

The Nobel Peace Prize for 1965 was awarded to the United Nations Children's Fund. Maurice Pate, who had by now become known as Mr. UNICEF due to his great vision, unfaltering dedication, and astute business management of the Fund, had just died. The $54,500 of the prize was used as the basis for establishing a living memorial to him; the money was used to train people in the developing countries in fields of service to children.

The Scope of UNICEF

In summary the following should be pointed out:

1. UNICEF is the only international agency devoted exclusively to helping children.
2. UNICEF assistance is given only on a government's request after a detailed plan has been submitted setting forth exactly how the aid is to be used and with the assurances of the commitments and responsibilities of the government.
3. Full responsibility for running the health, nutrition, welfare, or education projects rests on the individual government.
4. Every country receiving aid must match UNICEF's contributions. Many do contribute up to two, three, or four times that of UNICEF.
5. UNICEF's aid is given without regard to political belief, race, creed, or nationality.
6. UNICEF is supported entirely by voluntary contributions approximately sixty percent of which comes from governments and the balance from organizations and individuals.
7. Each project is planned eventually to become an integral part of the country's health, nutrition, or welfare and education services. The projects should be so planned that when UNICEF aid stops the individual country can and will continue and expand the program.

In 1961, it was said by UNICEF that:

> *In order to obtain long-term benefits, UNICEF favors aid for projects which:*
>
> *(a) are strategic in dealing with basic child care needs and have prevention as a principal objective.*
>
> *(b) train personnel in order to supervise the quality and scope as well as the quantity of service.*
>
> *(c) have an educational effect on the population and encourage its active participation.*

UNICEF helps promote the teaching of nutrition and eating habits as in this project in Ghana. (Courtesy of Food and Agriculture Organization)

(d) are adapted to the financial, technical and administrative capabilities of the country.

(e) set organizational patterns capable of being duplicated and extended elsewhere in the country.

The kinds of aid UNICEF is now giving are listed below.

1. *Health Services.* UNICEF supports a network of health services for mothers and children where expert advice and help are given to mothers and children. Technical equipment, supplies, and vehicles are provided for these services throughout the world.
2. *Disease Control.* UNICEF aids mass campaigns to control and prevent yaws, leprosy, trachoma, tuberculosis, malaria, and like diseases which take a particularly large toll among children.
3. *Nutrition.* UNICEF assists projects in the development and distribution of new foods needed for adequate nutrition through

school and community gardens, fish culture, and poultry raising. It also distributes dry skim milk, promotes local milk production and processing, and aids the development and distribution of new protein-rich foods. Practical nutrition education is also promoted.

4. *Family and Child Welfare Services.* These are set up to help improve family life. For families needing such help, provision of day care or care for children outside the home is promoted. Assistance is also given to projects in community development, to mothers' clubs, and to residential children's institutions.
5. *Education and Vocational Training.* Projects for training teachers, doctors, nurses, midwives, and social workers are assisted. Vocational guidance and training for young people, both in school and for school dropouts, are provided.
6. *Emergency Aid.* When other aid is inadequate or not available, UNICEF may provide aid for children who are victims of earthquakes, floods, or other natural disasters. UNICEF, however, prefers to assist in the rehabilitation phases, leaving the immediate emergency aid to other organizations.

Those who have worked in UNICEF in the last twenty years feel that a real beginning has been made but that the developing countries still need help to establish many services for children on a permanent basis so that these services can be adapted to meet changing needs. They believe that many countries need permanent health organizations which, reaching out into rural areas, deal with all aspects of child health. These countries are thought also to need a food and nutrition policy, functioning through all departmental services and affecting improvement of food habits and the production of food so that both rural and urban children are benefited. The leaders in UNICEF also see the great need for the development of education for the coming generation geared to the demands of a changing society, as well as for family and child welfare services to insure the protection of children. They also see a need for training personnel so that adequate staffs are everywhere available, not only to save the children but also to give them a chance to reach their greatest potential.

Sir Herbert Broadley, in a speech to nongovernmental agencies on UNICEF's role in the United Nations, said, after discussing the projections of population in the world by the year 2000, that:

> *Thus, members of the United Nations family are faced with immense responsibilities. And of all international organizations, UNICEF perhaps carries the greatest burden, in*

> *that to some degree the future of civilization lies in its hands. This does not imply anything derogatory to the great work being undertaken by FAO in increasing the world's food supply, by WHO in banishing diseases and improving health throughout the world, or by UNESCO in spreading the benefits of education to the less developed countries. Whatever benefits may occur to the adult population as the result of all these activities, it is the children of today who are the most important in that the future of the world will be in their hands.*

WHO: The World Health Organization

In 1966 the World Health Organization Assembly composed of 127 member states raised $51,515,000 for its 1967 budget through assessments on these member states. The annual Assembly meeting, usually held in Geneva, Switzerland, establishes policy and decides on the program and budget for the following year. The twenty-four persons, all qualified in health matters, who comprise this board meet twice annually to advise and act for the Assembly.

On May 7, 1966, WHO dedicated a beautiful modern headquarters building on the grounds of the Palace of the Nations in Geneva. This move from one of the original buildings occupied by the post-World War I League of Nations, as will be explained in this discussion, was quite symbolic of the long history of the international movement to improve and protect world health.

More than a century after the first organized efforts to promote international health, there were in 1966 more than three thousand doctors, nurses, technicians, and public servants of ninety-two nationalities carrying out programs at the WHO Headquarters and in one hundred and forty countries of the world. More than twelve thousand scientists, health administrators, and educators of many nations comprise the forty-four WHO expert panels whose advice guides the worldwide work of WHO.

For WHO purposes, the world is divided into six regions. The regional office for Europe, including the USSR, is in Copenhagen, Denmark; for Africa in Brazzaville, Republic of the Congo; for the Americas in Washington, D.C., for Southeast Asia in New Delhi, India; for the Eastern Mediterranean in Alexandria, United Arab Republic; and for the Western Pacific Region in Manila, Philippines. These regional offices are responsible for planning and operating country projects; the Headquarters' technical staff stand ready to advise and help.

In addition to the funds raised by assessment of member states, voluntary contributions have helped promote the work of WHO. Since 1955, malaria eradication has been promoted by contributions of more than twenty million dollars from governments, institutions, and private individuals.

Other special programs designated for such specific countries as the Democratic Republic of the Congo have received private contributions through the WHO Voluntary Fund for Health Promotion.

History of the International Health Movement

The international health movement had its inception when Europeans realized that cholera was spreading from country to country. They also began to wonder how disease was related to sanitation, to climate, and to the physical environment in general.

Programs in social welfare arose in Europe when rapid industralization brought overcrowding, poverty, suffering, and riots to the rapidly expanding urban areas. At this time, privately supported medical mis-

What does the future hold for these children in nutrition and health? (Courtesy of Food and Agriculture Organization)

sions under newly organized private philanthropic groups began to expand their spheres of action beyond national boundaries. Even in this era of strong nationalism, it became increasingly evident that national governments could not solve their own problems. Because of this the first International Sanitary Congress was called in Paris in 1851. The progress toward international planning and cooperation in matters of health was not continuous, but the general interest in international health spread and the present humanitarian objectives were coming to the fore.

In 1919, at an intergovernmental health meeting, the idea that the masses must accept the need for the proposed health measures and even understand them was brought forth.

Following World War I the newly formed League of Nations included in its covenant a statement calling for international concern for the prevention and control of disease.

In 1945, following World War II, when the delegates met in San Francisco to form the United Nations, the will to build the peace on firm foundations and a confidence that the use of existing scientific knowledge in health matters was held to be of paramount importance.

The proper food can help give this child a happy future.

Following an International Health Conference held in New York in 1946, the WHO Constitution was drafted; by 1948 fifty countries had ratified it. So on April 7, 1948, hence forth known as World Health Day, WHO was officially launched as an integral part of the United Nations with Dr. Broch Chisholm as its first Director General.

The opening paragraph of the WHO Constitution says: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." Upon retiring in 1953, in his last address, Dr. Chisholm said that all the principles included in the WHO Constitution "are based on this simple truth: in our shrunken world, health, like peace and security, is indivisible and mankind's fight against illness, its major enemy, can be won only through the concerted efforts of us all."

Nutrition in WHO

From the first, nutrition has been recognized as important in the promotion of good health. In the proposals made for the 1950 program, the Director-General and the executive board of WHO, at the Second World Assembly in 1949, said: "Nutrition is perhaps the most important single environmental factor influencing health." To support this it was stated that discoveries of recent decades show the importance of nutrition in the reduction of the infant death rate and in the incidence of infectious diseases as well as in the productivity of adults.

Because of the gravity of the problems of food production, FAO got started in 1945 three years before WHO. Even before the latter was formed in 1948, observers from the WHO Interim Commission who attended the second annual conference of FAO proposed that a joint committee on nutrition be formed. There thus began the close cooperation between WHO and FAO which has been carried out by the Joint Expert Committee ever since.

In 1925 the Health Organization of the League of Nations began a study of nutrition, but active international interest really only began in 1935 with the circulation to governments and scientific bodies of a report of the Technical Commission. Sounding like modern concerns, in 1936 there was proposed study of the nutritional status of children, of nutritive requirements especially for young children, and of factors influencing nutritive requirements. Because the needs for nutrition emphasis in public health were already understood, at the World Health Assembly in 1948 nutrition was granted the same high priority as malaria, maternal and child health, tuberculosis, and veneral diseases. A nutrition section was immediately established within the Secretariat of WHO.

As was mentioned previously, the Joint Expert Committee of FAO and WHO was established and convened for the first time in October 1949. At this and subsequent meetings, this committee made vital contributions, including:

1. Discussing individual and joint programs of the two organizations.
2. Giving expert advice on problems referred to them.
3. Examining problems of malnutrition of international concern and making recommendations for action to FAO and WHO.
4. Making suggestions for assistance to establish national food and nutrition organizations in member countries.
5. Directing attention to training and education of personnel needed in national nutrition activities.

In 1959 some of the practical aspects of cooperation of the two agencies were critically evaluated and an agreement was drawn up, as stated in the book, *The First Ten Years of WHO*. WHO agreed to concern itself with "nutrition as it affects health; the objective of FAO is to raise the levels of nutrition and standards of living, and to improve the efficiency of all food and agricultural products."

A specific example of the cooperation of WHO and FAO was shown when, in 1962, FAO and the United Nations launched the World Food Program. This was aimed at making plans for social and economic progress in developing countries and at relieving malnutrition by the organized use of surplus foods. WHO acttively cooperated by: (1) examining the health implications as well as those concerning nutrition of the projects proposed, (2) following the progress of these projects, and (3) evaluating later the effects of these programs on the health of the populations involved.

For almost two decades now the Joint Expert Committee has been concerned with the extent of malnutrition and the indices for determining this. Its efforts have pointed to the urgent need for comparability on an international scale of methods of collecting data. Study continues on problems such as assessment of nutritional status and nutritional requirements as well as of such diseases as goiter, xerophthalmia, nutritional anemia, protein-calorie malnutrition, and certain degenerative diseases. The increasing use of food additives led to a joint committee being appointed in 1956 to discuss the general principles which should govern the use of them. By 1964, recommendations for a number of food additives were drawn up. The use of pesticides also was studied by another committee, and principles governing consumer safety were established.

WHO also has cooperated with UNICEF, ILO, and UNESCO. The record of field projects conducted from 1948 to 1964 in member states by the Nutrition Section of WHO is impressive. Twenty-three short surveys (some with advice to the government) have been conducted; five comprehensive nutrition surveys and recommendations to governments have been made as well as an equal number of such surveys with aid in developing programs. Specific diseases have been studied in fourteen countries; seven programs including *Nutrition and Parasitology, Dietetics, Social Anthropology, School Feeding*, and *Milk Conservation* have been completed. Aid has been given to eleven nutrition departments, nutrition institutes, or university units. The promotion of the training of health personnel in nutrition has a top priority rating now with WHO. Between 1947 and 1963, WHO provided 544 fellowships in nutrition, approximately two-thirds of which were held by people from the Americas, Africa, and Europe.

WHO emphasizes nutrition as an inseparable component of health which needs to be integrated by governments into their health plans; this particularly is stressed in the developing countries. During the past fifteen years, WHO has employed approximately one hundred and fifty nutrition experts as consultants to study malnutrition and to advise on its control and prevention.

As the result of all of these efforts, more attention is being paid in the developing countries to the teaching of nutrition in the medical schools and to building up contacts between medical schools in the developed and developing countries. Particular emphasis has been given to the need for pediatricians, maternal and child health specialists, and public health physicians to receive specific training in nutrition to enable them to handle the problems of malnutrition in mothers and young children.

For some years now WHO has also recognized the need for training at various levels; with FAO it has organized ad hoc training courses and seminars. From 1948 to 1964, seven training courses were held in Europe, Asia, and Africa. Eleven symposia and seminars were held in these regions in addition to Central and South America. Six training centers were established in the same regions; two surveys of training going on were conducted, one for India, the Americas, and Africa, and the other for Europe.

A five-year program in nutrition for WHO was projected in 1965. It included proposals to:

1. Advise and assist member states to continue to define their problems in nutrition and to initiate action for the control and prevention of malnutrition.
2. Intensify efforts toward making prevention of malnutrition an integral part of national health planning as it relates to provision of basic health services, especially for mothers and children.
3. Increase efforts to provide adequate facilities to train medical and paramedical personnel in nutrition.
4. Continue research into the etiology of nutritional disorders and disease.
5. Promote knowledge of epidemiology of nutritional disease so preventive measures can be instituted.
6. Periodically assess the nutritional status of a population to determine the effect of changing conditions. In doing this it is proposed to collect information on heights and weights of children in developing countries under differing socio-economic conditions. Norms for well-nourished children in these countries could thus be established. Then longitudinal and cross-sectional studies could assess the value of specific programs.
7. Continue to study the interrelationship of nutrition and infection.
8. Study desirable weight gain in pregnancy, the effect of nutrition on fetal growth and birth weight, and the physiological cost of pregnancy and lactation in terms of increased need for nutrients.
9. Study energy requirements and essential nutrients for industrial workers in the interest of maximum efficiency. In consequence,

it is hoped that it will be possible to recommend group-feeding procedures to meet these needs.

10. Study effect of nutrition on degenerative diseases.
11. Continue to study acceptable levels of the major known essential nutrients with the hope that these can be established by 1970.
12. Draw up specifications for the toxicological evaluation of the antimicrobials, antioxidants, emulsifiers and related substances, bleaching agents, and food colors, as well as miscellaneous additives. Also continue work on the toxicity of pesticides.

Thus the vital character of nutrition work in WHO continues into the future.

Cooperative Relations of United Nations Agencies

Very soon after the creation of FAO, WHO, and UNICEF, it became apparent that committees to handle problems common to all of these organizations would be necessary.

In 1960 Maurice Pate, then Executive Director of UNICEF, said:

> *Over the course of the years a network of cooperative relationships has developed between UNICEF and the World Health Organization and also the Food and Agriculture Organization—relationships both of a formal and intimate character—to assure that the available international resources are aligned in the most effective ways possible in helping government projects.*

Much of this cooperation has been accomplished through interlocking committees for planning and policies. Dr. E. DeMaeyer, technical secretary for the Protein Advisors group of WHO/FAO/UNICEF in 1966, outlined the function of sixty-nine applied nutrition projects in fifty-seven countries, all of which were under this cooperative organization. These projects concerned:

1. The elaboration of national food policies.
2. Identification of the socio-cultural and economic factors influencing local diets.
3. Improved utilization of foods through better systems of handling, storage, and processing.
4. Commercialization contributing toward improvement of the nutritional situation in general.

Seven agencies of the United Nations cooperate to teach Bolivians to raise better potatoes. (Courtesy of United Nations)

5. The prevention of protein malnutrition in the more vulnerable groups in the population.
6. Home economics activities for the improvement of food utilization and living conditions in the home and at the community level.

These three agencies of the United Nations have also established training courses at INCAP, one for London-Ibadan, Nigeria, one for France-Senegal, another in Peru, and one in India.

WHO and FAO also cooperate but have slightly different purposes in their joint efforts. They linked, in 1965, several functions of their efforts:

1. Assessing the problem of nutrition.
2. Assessing the food supplies and food consumption in different countries.

3. Advising on national nutrition and food policy and programs.
4. Training and educating in nutrition.
5. Feeding at the institutional level.
6. Setting up recommendations for nutritional requirements.

In these programs, nutrition and food production are seen in their relation to health.

This working together was furthered in 1959 when the Directors General of WHO and FAO examined the practical aspects of their cooperative efforts and reached an agreement as to which group would be responsible for what part of the program in nutrition and what would be done jointly. For instance, FAO agreed to take over the responsibility for school-feeding programs and WHO for nutrition through maternal and child health centers.

Close cooperation in nutrition programs of WHO and UNICEF began with the concentration to produce indigenous protein-rich vegetable foods in the countries where protein-calorie malnutrition is a serious problem. At about this time the *Expanded Nutrition Program* of UNICEF was launched, and this called for close working with WHO.

The International Labor Organziation of the United Nations (ILO) and the United Nations Education, Scientific, and Cultural Organization (UNESCO) have worked with WHO in recent years on the nutrition problems of industrial workers and to promote nutrition education in the schools.

The United Nations and FAO's World Food Program, launched in 1962, has enlisted WHO, to examine:

1. The nutritional and health implications of the projects proposed.
2. The projects during their implementation insofar as they affect the health situation.
3. The effects of the programs, at appropriate stages on the nutritional status and health of the populations involved.

Nevin Scrimshaw said in 1963:

> *The most extraordinary and hopeful development in international nutrition has been the way in which in the last decade WHO, in cooperation with FAO and UNICEF, has led a vigorous and effective assault on the widespread problem of protein malnutrition and on the accompanying high prevalence of kwashiorkor and marasmus in young children in technically underdeveloped areas.*

He also says that:

> *It is an inspiring record of accomplishment with the full effects only beginning to be felt.*

Thus, on the practical level and to the benefit of all concerned, efforts toward cooperation in the field of nutrition have been attempted. As the ever expanding population presents what seems to be almost insoluble nutrition problems, such cooperation is becoming even more imperative.

Western Hemisphere Health Programs

All nations share in the work of the United Nations and specialized agencies, but in the Western Hemisphere health programs are developing which are directed toward meeting the particular needs of the millions of people in Latin America and the Caribbean.

The problems of Latin America are numerous, varied, and in many areas severe; there is a high incidence of infectious diseases, malnutrition and hunger, poor sanitation, poor housing and working conditions, illiteracy, and poverty. No one country has sufficient resources, facilities, and trained personnel to solve immediately its problems.

PAHO: The Pan American Health Organization

In 1902 the Pan American Sanitary Bureau was founded to assist the governments of the Americas in improving the level of health in each of the member countries. After the creation of WHO in 1948, the Pan American Sanitary Bureau was named as the regional office of WHO. Hence, it is the oldest international health organization in the world. Its basic purpose is to promote and coordinate the efforts of the countries of the Western Hemisphere "to combat disease, lengthen life, and promote the physical and mental health of the people."

The headquarters of the Pan American Health Organization are in Washington. The member countries elect the Director of the Bureau, determine its policies and programs, and contribute financial support to its operations.

The work of the Bureau is directed essentially to providing advisory services to the countries in the planning and development of their health programs, assisting in training personnel, and carrying out cooperatively with the countries research activities directed toward solving some of the fundamental health problems. In particular, the Bureau provides to individual governments advisory services in all established fields of health, organizes seminars and training programs, communicates and distributes epidemiological information and health statistics, and provides national as well as international fellowships for training of health personnel.

Activities related to food and nutrition have been increased during the past few years as a result of the growing awareness of the importance of nutrition not only as a factor in improving and maintaining health but also because of its contribution to the social and economic development of the countries.

The work of the Pan American Health Organization is carried on in a decentralized manner through zone offices and offices located within each country of a zone. A Medical Nutrition Officer is assigned to each of the six zones. Within the countries nutritionists may function in specialized projects; these nutritionists may or may not be physicians. Their responsibility is to assist the country in developing programs which will meet its specific nutritional needs. In the headquarters office in Washington, there are two nutrition advisors who work with the zone advisors and coordinate the programs of the organization with bilateral and international programs of other agencies.

INCAP: Institute of Nutrition for Central America and Panama

The six small countries of Central America have created a unique organization to carry out research and training and to provide advisory services for nutrition work in their countries. This is called the Institute of Nutrition for Central America and Panama (INCAP).

INCAP was formally inaugurated September 14, 1949, with Dr. Nevin Scrimshaw as its first director. Following a diagnosis of some of the major nutrition problems in Central America, the Institute initiated research to determine some possible solutions for these problems. The research produced amazing results and many publications, all within the limitations of a small budget. As the work of the Institute expanded and the need for staff increased, there was need for construction of permanent quarters. With the assistance of the Kellogg Foundation, the first permanent building was constructed; in the succeeding years, additional buildings have been added. INCAP has become the center for nutrition research, education, and training. One of INCAP's achievements, which has provided a stimulus and a pattern for many other countries and regions of the world, is the production of a protein-rich vegetable mixture called Incaparina. A detailed description of Incaparina was given on pages 245–246.

AID: Agency for International Development

AID is an agency of the United States Department of State. The general purpose of AID is "to help developing countries achieve economic strength and momentum so they can provide for a better life for their own people, using their own knowledge and their own resources." This statement was made by David E. Bell, then the AID administrator, on February 21, 1966, in Memphis, Tennessee. He added, ". . . and at that point, we want to end our aid." And it has been possible in the history of AID and its predecessor agencies to terminate assistance and for nations to proceed independently. Spain, Greece, and most recently Taiwan (June 1966) are operating independently. The closing steps are in process in Israel, Mexico, and Venezuela as this is written (1967), leaving the active AID programs in other Latin American countries, Africa, and Asia only. Some of the former recipient countries are now helping other nations who are in the developing stages.

Program emphases in AID are in three general areas: agriculture, health, and education. Agriculture and health have programs directly related to nutrition. In 1966 a plan for intensified effort in the area of nutrition was initiated utilizing and expanding the ongoing programs in AID and enlisting the agencies, industries, and government of the host country in a united and concerted attack on the vast problem of malnutrition.

Food production is the aspect of the nutrition program directly related to agriculture, and the record has been a successful one in increasing production. In East Pakistan between 1955 and 1965 the average production of rice rose from 7.4 to 11.5 million tons. Improved seed was used, regular spraying was practiced, fertilizer was applied, the land was irrigated, an agricultural extension education program was conducted, and roads from farm to market were built through a public work program. In South India the yields of "ragi," a millet on which ten to fifteen million people depend for food, were increased ten times by the use of fertilizer and a few simple changes in cultivation.

From 1948 through 1963, in twenty-one of the twenty-six countries receiving assistance, the rate of increase in crops exceeded the rate of increase in population. However, in spite of this, a food crisis exists. Population increase is one factor but, in addition, demand for food is increasing with rising incomes in some of the less developed countries.

The experiences of AID have demonstrated the kinds of assistance, the kinds of national investments, and the kinds of national policies that can produce a rapid growth in food production.

Identified as one of the most important factors in agricultural progress is the education of local personnel. The task of first priority of the AID expert is that of training persons of the host country to do the task that he is doing. Thus there is a continuing program of training in the United States for advanced or specialized study. Also through the assistance of AID, the number of students enrolled in schools and colleges within the less developed countries is increasing.

American land grant universities, under contract with AID, are helping in the creation of agricultural training institutions, centers for practical research, and agricultural extension services to help the farmer translate the research findings into action on the farm. It was found in East Pakistan that demonstrations of improved methods were accepted best when farmers themselves conducted them rather than when some model plot was used at the research institute. It is reported that "to the farmers of Mymensingh (East Pakistan) line-sowing, the use of fertilizer, small pump irrigation, and other innovations were worth copying only if they worked for a neighbor whose farm and whose means were on the same small scale as their own."

Agricultural credit is of fundamental importance. If the farmer wishes to use better seed and to apply fertilizer but has not the money to buy them, his effort is paralyzed. In Mexico the agricultural credit program is termed a breakthrough. It is jointly supported by AID, the World Bank, and the Mexican government. Private banks in Mexico have begun for the first time to loan money to farmers for productive purposes.

A means of transportation is also necessary—to take tools, seeds, and fertilizer to farmers and to bring crops back to the markets. In Thailand, corn export today is important. One-third of the corn crop comes from a new agricultural area opened by a ninety-mile, AID-financed highway which permits produce to reach Bangkok in a few hours by truck.

One of the challenges to agriculture is to supply specific nutrients. Protein is one of the serious lacks. To contribute to solving this need, technical assistance is being made available to local food-processing industries to help in the development of methods for using the proteins of the domestic oil seed crops. Also, a number of American food processors are experimenting with inexpensive protein-rich cereal products that could be popularized in the less developed countries. For these industries AID gives priority consideration by guaranteeing coverage for private American investments in food-processing improvements in other countries.

As has been mentioned, the sea as a source of protein is being exploited also. Some of the countries where AID assistance has helped to expand the off-shore food source are India, Pakistan, Korea, the Somali Republic, and Nigeria. Extension services are showing farmers how to harvest fish from their own village ponds. With assistance from AID technicians and their own extension agents, villagers in East Pakistan increased the production per pond from seventy pounds to a ton of fish during a three-year period.

AID also employs "stop-gap" food distribution until the developing country can be self-sufficient in its food supply. Through Food for Peace, commodities from the United States have been distributed in a variety of programs in many countries. Taiwan may be used as an example. Voluntary agencies—Catholic Relief Services, Lutheran World Relief, and Church World Service—began in 1951 to distribute food, concentrating chiefly on family feeding. There was also distribution to schools, institutions, health centers, and maternal and child welfare centers. In 1966 the emphasis changed, with family feeding giving way largely to food-for-work activities. Since 1962 the economic development programs in cooperation with the Taiwan Provincial Government have used United States' food as part pay to workers on such projects as rural construction and resettlement, flood control, irrigation, reforestation, tidal land reclamation, and road construction. This plan has made a significant contribution to the country's economic strength.

Strong emphasis is being placed on nutrition in the health phase of the AID program. The expressed objective is "the progressive elimination of malnutrition among mothers and children." One of the challenges at present of the AID missions around the world is that of exploring ways of getting the necessary enriched food supplements to preschool children.

The program includes education of physicians, health workers, and mothers. It calls for social services for families in their homes and through child care centers. Also included is the study of local customs and eating habits so that the enriched foods may simulate in taste and texture the ones to which the people are accustomed in an effort to make them acceptable. Also the nutrient composition of the usual diet needs to be determined in order to know the dietary inadequacies and direct the production of crops to help supply these needs.

Another aspect of the AID nutrition program is research. Projects are of a practical nature, seeking information to make for a more effective program. Among them are: evaluation of high-protein supplements in child-feeding programs in the Philippines; investigation in Latin America of nutritional factors contributing to mortality and morbidity in childhood; feasibility of extending protein concentrates by addition of inexpensive nonprotein nitrogen sources; clinical techniques for evaluation of new protein materials for prevention of malnutrition in infants and young children; relationship in Africa between aflatoxin in the food supply and human liver disease; and influence of early nutrition on cognitive development in the young child.

Through the efforts of AID in the areas of agriculture and health and the cooperation of the host government and agencies, an attack on malnutrition, which is to be extended to many countries, is underway.

FFP: Food for Peace

In 1965 President Johnson proposed "that the United States lead the world in war against hunger." The Food For Peace Act was passed by Congress in October 1966 and became effective January 1, 1967, for a period of two years. This act authorizes Congress to spend ("in terms of Commodity Credit Corporation Cost") 1.9 billion dollars for the sale of food to needy countries and 600 million dollars for donations of agricultural commodities for each of the next two years. The act also authorizes a carryover of unused funds amounting to 2.7 billion dollars.

This act provides for the production of farm products to meet the need for food rather than the reliance on food surplus. Food can be used to support increased production of food in countries where there is a food shortage; labor can be paid for with food. Countries which request help may use money from the sale of their food to support population planning projects.

The idea of self-help implied in this legislation is new.

The countries selling, furnishing, or permitting transportation by ship or aircraft of equipment, materials, or commodities to Cuba or North Vietnam while they are governed by a communist regime can not benefit under this act. However, medical supplies, nonstrategic raw materials for agriculture, and nonstrategic agricultural or food commodities do not come under this restriction.

In assessing where the aid shall go the following criteria are to be used:

1. Devotion of land to the needed food production rather than to nonfood crops, especially those in world surplus.
2. Development of agricultural, chemical, transportation, farm machinery and equipment, and other necessary industries through private enterprises.
3. Training and instruction of farmers in agricultural methods.
4. Construction of adequate food storage facilities.

5. Improvement of marketing and distribution systems.
6. Creation of a favorable environment for private enterprise and investment and promotion of technology.
7. Establishment and expansion of institutions doing agricultural research.

The increasing emphasis on the recipient country developing self-help programs rather than reliance on outright gifts of food was recognized in Congress as a real step forward.

Nutrition Section, Office of International Research, National Institutes of Health

For this section, we quote directly from a personal communication kindly contributed by Dr. Arnold E. Schaefer, head of the Nutrition Section, the Office of International Research, National Institutes of Health.

> *The Nutrition Section, Office of International Research, is located at the National Institutes of Health and was established on July 1, 1965. From 1955-65 it was the permanent secretariat for a small group of specialists in nutrition and public health known as 'ICNNC'—the Interdepartmental Committee on Nutrition for National Defense—which was made up of representatives from various government agencies. The Nutrition Section's financial support comes from the Department of Defense, the Advanced Research Projects Agency (ARPA) and the Agency for International Development (AID). One of the Section's major international roles is in guiding, developing, and monitoring the feeding programs of AID and Food for Peace (FFP). Other services for AID are: technical and scientific review and evaluation of these programs; technical advice on development and testing of food mixtures, using locally produced food and FFP commodities, with the goal of upgrading the FFP donated foods and the key emphasis on using the local food and manpower resources of the country; preparation of technical and educational materials; technical support services, including participant training, and briefings for FFP and AID personnel; and coordination of AID-supported nutrition programs with those of PAHO, WHO, FAO, UNICEF, and other Federal agencies and private organizations.*

Other major activities include the preparation of background reports and information reviews on specific countries eligible for nutrition programs. The Section conducts country nutritional surveys only upon the request of the country involved. These surveys are carried out by multidisciplinary teams (physicians, dentists, biochemists, dietitians, nutritionists, agriculturalists, and food technologists) that also include counterpart personnel from the host country.

To date the Nutrition Section has completed nutritional surveys in thirty-two countries: Iran, Pakistan, Korea, Philippines, Turkey, Libya, Spain, Ethiopia, Peru, Ecuador, Vietnam, Chile, Colombia, Taiwan, Thailand, Lebanon, West Indies, Burma, Uruguay, Jordan, Bolivia, Malaya, Brazil (northeast), Venezuela, Nigeria, Paraguay, Guatemala, El Salvador, Costa Rica, Nicaragua, Honduras, and Panama. The last six surveys were carried out in collaboration with the Institute of Nutrition of Central America and Panama (INCAP). Nutritional surveys help to define the major nutrition problems, research needs, and the development of recommendations to insure the maximum use of local resources.

The procedures used are described in the Manual for Nutrition Surveys *which was developed by the ICNND. The Manual and survey reports resulting from the surveys are used for teaching purposes in many medical schools and by the Peace Corps and other governmental agencies.*

Some of the research projects which have been instituted as a result of the findings of the surveys are: (1) the response of megaloblastic macrocytic anemias in kwashiorkor to vitamin E and selenium; (2) zinc deficiency in relation to the dwarfism-infantilism syndrome prevalent in the Near East; (3) normalization of impaired glucose utilization and hypoglycemia by chromium in malnourished infants; (4) the relation of sulfate metabolism to urolithiasis, considering the extremely high incidence of bladder stones; (5) urinary amino acid excretion in relation to protein nutriture; and (6) the evaluation of applied feasible methods of eradicating goiter.

The Nutrition Section is presently working in collaboration with AID in the establishment of food evaluation centers and in the development of research projects which are

> *directed toward the development of local infant formula foods which are wholesome, acceptable, and inexpensive to serve as a replacement for the world's diminishing supply of milk. A Food Composition Table for Africa is now being completed in collaboration with FAO, and a 'Food Composition Table for Use in Latin America' has been published in English and Spanish in cooperation with INCAP.*

Peace Corps

On March 21, 1961, by executive order of then President John F. Kennedy, the Peace Corps came into existence with its stated purpose: "to promote world peace and friendship by making available to interested countries Americans who will: help the people of these countries meet their needs for trained manpower; help promote a better understanding of the American people on the part of the peoples served; and help promote a better understanding of other peoples on the part of the American people."

For many decades, organizations and groups in the United States and other countries have been working in various ways to help people in other parts of the world. It was something new for the government of the United States to organize such a program on a worldwide scale, but the time was ripe for American action. Many individuals gave support and arduous labor to the detailed planning and organization necessary to make the Peace Corps a reality. Some were on the sidelines vigorously expounding on the problems, hazards, and difficulties of such a venture. But the youth of America responded to the new opportunity to do something for others. They joined the Peace Corps, not as salaried workers in another country, but as volunteers receiving a living allowance and living and working for twenty-four to twenty-seven months under the same conditions as the people they were to assist and at the invitation of the host country.

In the past five years of the Peace Corps' existence, twenty-five thousand volunteers have served abroad, with fifteen thousand currently on duty in fifty-two countries around the world. These workers are serving in four hundred separate programs with fifty percent engaged in teaching and twenty-seven percent in rural and urban community development; health is the next largest category, followed by agriculture and public works. All these young men and women have met the requirements of being over eighteen years old and in good physical health; some have been married couples and some have been in the upper age group—175 volunteers have been over fifty years old and 69 have

A Peace Corps nurse instructs a mother about child care in Bolivia. (Courtesy of Peace Corps)

been in the sixty-one to seventy year bracket. All have undergone a preliminary training session of ten to fifteen weeks at a college or university with half that time concentrated on study of the language of the country in which they planned to serve. Some have joined the Peace Corps due to idealistic motives, but most have had mixed goals including a chance to travel, to learn, to feel important, to try something on their own, or to respond to a challenge.

Many of the projects undertaken by Peace Corps volunteers have been related to food for people and have helped to bring some improvement in food practices to many families and communities. This has been achieved through direct teaching about nutrition in schools, adult classes, and clinics, and especially through school-feeding programs. Many times the volunteers have followed a more indirect approach such as helping women in a community to use more of the foods that are available, introducing a new food of good nutritional value, showing a new way to cook the everyday foods so that more food value will be retained, and helping women to protect and preserve food.

Home economists have served in more than twenty countries where they have organized curricula and taught classes in secondary schools, colleges, and technical institutes. They have helped to train women who will carry the information to their own communities. Some have helped in extension programs and 4-H clubs; others have helped in preparation of food in hospitals and schools.

Many volunteers, men and women, have helped indirectly to improve the health of people through their work in communities and often directly with families on a people-to-people basis. Improving sanitation and hygiene, building schoolrooms or just getting some school classes underway, guiding the tilling and treating of the soil to get a better crop, and starting a project in raising some different kind of food are all pathways to better health and better living. Wherever the volunteer works, it is through his own ingenuity and use of his own particular talents and abilities that he brings a true sense of the feeling that American people do care about people in other countries. There have been failures and there have been marked successes, but in general change comes slowly; five years of work are too short a time to evaluate the full impact of the Peace Corps' efforts at the village and community level in developing countries.

SOME INTERNATIONAL PROGRAMS OF FEDERAL AGENCIES

A few of the international programs are reviewed here to indicate another type of assistance.

The 1954 Agricultural Trade Development and Assistance Act, usually known as Public Law 480, was passed by the Eighty-Third Congress. Under this law, foreign currency was to be accepted in payment for surplus American food sold to countries friendly to us and needing the food. This currency was to be deposited in the country of origin. It could be used for projects to benefit the people of that country. Several departments of the United States government have carried on programs in a number of countries. Some of these programs use P.L. 480 funds and others do not.

The National Institutes of Health

The National Institutes of Health are currently sponsoring studies on anemia in relation to parasitic infections and malnutrition in Egypt. The development of protein-rich foods in India is also being studied along with metabolic studies on vitamin A and nutritional deficiencies in general. Other studies currently being pursued include calcium metabolism in periodontal disease and in osteophoris in Israel, the effect of indigenous fats and oils in nutritional problems in Pakistan, and the pediatric approach to health problems in Pakistan.

The National Institute of Child Health and Human Development, in their own international program, not under P.L. 480, has a large grant at INCAP. This significant study concerns the possible relationships between malnutrition, social variables, and intellectual development in a rural village population. The study, planned to extend over a seven- to ten-year period, will compare children all under six years of age, one group nutritionally supplemented and the other not.

The Children's Bureau

The Children's Bureau has no operating program in nutrition overseas but carries on in the international field many activities of a consultative and advisory nature which correspond to its domestic responsibilities according to Dr. Katherine Bain, Assistant Chief for International Cooperation, a small but active division of the Bureau.

Through an arrangement with AID, the Children's Bureau has on its staff a nutritionist with competence and experience in maternal and child health and experience in working overseas.

This Bureau cooperates with such voluntary agencies as CARE, Catholic Relief Service, Church World Service, and Caritos. The Children's Bureau also serves as a focal point in the United States government for cooperation with UNICEF whose nutrition programs approximate eighteen percent of its budget. Similarly, proposals dealing with child nutrition which are considered by WHO and FAO are also reviewed by the Children's Bureau.

The Agricultural Research Service, Department of Agriculture

Dr. Ruth Leverton, Assistant Deputy Administrator of the Agricultural Research Service (ARS) of the Department of Agriculture, reported in 1966 that the Human Nutrition Research Division of ARS has, since 1962, taken advantage of the possibility of foreign grants under P.L. 480 to study urgent human nutrition problems in laboratories of outstanding investigators in ten countries. Of the eighteen projects executed to date, nine were concerned with the nutritional values of specific foods, formulated mixtures, or supplemented diets with special attention to protein values. Other studies concerned patterns of food consumption such as food qualities important to consumer acceptance; some pertained to fat metabolism and others to energy expenditure in a population. Some studies also concerned the interrelationships of nutrients and foods which are important to long term optimum well being. In Israel this sponsored research devised, for use with malnourished children, a low-cost, protein-rich food using chick peas, defatted sesame flour, and soybean flour.

It is said that increasing emphasis in this program is being given to research oriented to solving some of the *practical* problems of feeding a hungry world. Some of these programs deal with the fortification of wheat with the amino acid lysine to make it a more valuable food for man. Some studies deal with producing new varieties of wheat which give a higher yield per acre. In a project in India, eight Department of Agriculture scientists are working to produce pulse crops (edible legumes like peas and beans) which give a high yield per acre and also have a high nutritive value.

This branch of the United States Department of Agriculture has also been influential in guiding policies relating to human nutrition such as the fortification of foods shipped for foreign-aid programs.

Food and Nutrition Board

The Food and Nutrition Board of the National Academy of Sciences, National Research Council, had its origin in 1940 when our country was on the brink of war. At that time a Committee on Food and Nutrition was appointed to have as its major concern the national situation with regard to the extent and causes of malnutrition and how to improve the nutrition of all our people. A study was made of the quantitative needs for nutrients for all age groups under all circumstances in order to maintain our population in vigorous health and also the estimate of the quantities of various foods that would be required to supply the necessary nutrients. From this study came the Recommended Dietary Allowances approved in 1941 and first published in 1943. These Recommended Dietary Allowances have been revised periodically ever since in order to take advantage of new research and new interpretations of nutritional requirements. The sixth revised edition was published in 1964.

The Food and Nutrition Board has been concerned primarily with the application of nutritional science in the United States, but international cooperation on problems of food and nutrition also has been a strong feature of the Board's continuing program. A committee on protein malnutrition has administered grants from the Rockefeller Foundation to assist nutrition scientists in some twenty countries in combating protein malnutrition, particularly in mothers and preschool children. This has been done in cooperation with FAO, WHO, and

UNICEF. The committee on international programs of the Board has prepared brochures, "The Roles of Nutrition in International Programs" and "Recommendations on Administrative Policies for International Food and Nutrition Programs." It also has made recommendations on policy principles in food and nutrition in national programs; these have been applied in AID and in Food for Peace programs.

Other activities of the Food and Nutrition Board are illustrated by the titles of some of its publications: "Tables of Food Composition," "Maternal Nutrition and Child Health," "Control of Tooth Decay," "Safety of International Chemical Additives to Food," "The Role of Dietary Fat in Human Health," "Evaluation of Protein Nutrition," and "Meeting Protein Needs of Children." These have not only served as a basis for nutrition guidance and teaching in this country but have had a broad effect internationally.

Members of the Food and Nutrition Board are appointed from among leaders in the fields of food and nutrition, and they serve without compensation beyond their actual expenses. The Board is an advisory body which promotes research in food and nutrition and interprets nutritional science in the interest of the public welfare. It may act on its own initiative or at the request of public and private agencies. Financial support for publications and for meetings comes from agencies such as the Nutrition Foundation, the Milbank Memorial Fund, and the Williams–Waterman Fund of the Research Corporation. Support for special projects and purposes may come from private agencies and government contracts.

PRIVATE FOUNDATIONS

Two independent foundations that are contributing materially to programs for increasing the quantity and quality of food produced in the developing countries of the world are the Ford Foundation and the Rockefeller Foundation. They both are, and have been for several years, working at the invitation of governments to support needed research, give technical expert assistance, and provide training for local scientists and technicians. Each foundation has a number of separate projects to which it gives support, but in many cases they give joint support.

Ford Foundation

In 1951 the Ford Foundation expanded its programs to include Overseas Development, and by 1961 it was providing aid to thirty-two countries and territories in South and Southeast Asia, the Near East, Africa, Latin America, and the Caribbean area. One of the first overseas grants was to India in 1951 at the request of Prime Minister Nehru, and since that time continued support has been given India in areas of developing its human resources. Emphasis has been on education, rural development, public health, small industries, and urban problems. Indirectly at least, all these areas help to improve the food supply and the nutritional well being of the people through improved production, purchasing power, and knowledge. We suggest the reading of *Roots of Change* by the Ford Foundation to catch a glimpse of what can be achieved by men of vision and knowledge to help fellowman help himself.

The Package Program in India illustrates one of the projects related to food that is receiving aid from the Ford Foundation. This is the popular name for the Intensive Agricultural District Program of India originated by the government of India. The "Package" is a combination of interacting practices such as using better seeds, cleaning and treating seeds for protection against diseases, using improved implements, using fertilizers at the right time and in the right quantities, using water more effectively, and taking suitable plant protection measures. The earlier efforts to help farmers concentrated on trying to change only one agricultural method at a time. The Package uses the latest methods based on research and adapted to the particular district; it coordinates a number of new practices which are all taught at the same time by the demonstration plot method where the farmers can see and follow what is happening.

Farmers change when they see results and when the new methods bring them more income. Some results of the Package Program so far have been that rice and wheat yields have increased twenty to fifty percent and higher yields are envisoned when new varities of seed become available. The farmer has obtained an average of two or more rupees return on each rupee invested in his crop. More farmers are adopting the improved practices, and more farmers are putting these practices into effect on more of their land after trying it on a small scale first. The number of farmers using the Package has increased from 205,000 in 1961 to 1,105,000 in 1964.

Rockefeller Foundation

If you read any recent President's Review from the *Annual Report of the Rockefeller Foundation*, you will gain a new vision of how people in many countries are being helped to produce more and better food. In the 1965 report, some eighteen pages tell what is being done under the topical heading, "Toward Conquest of Hunger." Many countries, including those in Latin America and Africa, are dependent on corn for the basis of their diet. For twenty-three years, scientists from the Rockefeller Foundation have worked closely with other institutions and governments to collect systematically and preserve different varieties and types of corn and wheat. These are kept in seed banks in Mexico, Colombia, and Brazil.

> *A corn breeder in Nigeria who needs a genetic strain resistant to certain kinds of pest or diseases, a geneticist in India in need of a drought-resistant strain, or an Egyptian scientist looking for lines giving higher yields under irrigation can find these in Látin American germ plasm banks. From Mexico alone in 1965, seed shipments went to thirty-nine countries and to nineteen states in the U.S.*

Fish is an important source of protein. Fresh water and brackish water ponds in Southeast Asia and Pacific countries can be a means of providing an inexpensive fish supply. The Foundation is supporting research in experimental pond fisheries in Taiwan and the Philippines focusing on ways to increase the yield from these ponds through more efficient management techniques and through biological research on the breeding and growth of fish.

Sorghum is a basic food of man in Africa and India because it can be grown in areas where corn fails because of drought and very poor soil conditions. If more can be learned about the production of sorghum under varying climatic and soil conditions, and if new, hardier, and higher yielding breeds of sorghum can be developed, then land that is now unable to produce food may be brought into profitable production. The Rockefeller Foundation has made grants to the University of Nebraska for an intensive research study over a five-year period on these problems of producing sorghum.

The Foundation not only sends leading scientists to various countries to work on research projects designed to improve and increase food production, but it also helps to train local scientists on the spot and provides scholarships and fellowships for study elsewhere. The Foundation's goal is to help countries to be able to take over these food and agricultural programs with their own well-trained scientists.

These are examples of but one phase of the work of the Rockefeller Foundation.

IRRI: International Rice Research Institute

The Ford Foundation and the Rockefeller Foundation jointly support some of the same projects. One of these is the International Rice Research Institute. This Institute was incorporated in 1960 and dedicated in 1962 as a world center for the study and improvement of rice by the government of the Philippines with the cooperation of the Ford Foundation and the Rockefeller Foundation. It is located at Los Baños, forty miles southeast of Manila.

A visit to IRRI is an exciting event. One looks out over close to two hundred acres (eighty hectares) of experimental farm and sees endless experimental plots with rice in every stage of growth and maturity and every type of treatment of the soil, seeds, and plants. Here ten thousand varities are being studied, using varying types of cultural practices and water and soil management. On some plots one sees cariboa pulling plows through the heavy wet soil.

IRRI is primarily a research center seeking to get more abundant rice yields through improved cultural practices and by development of new and improved varieties. The search is for a variety that: (1) has stiff straw so that it will not lodge or fall over, (2) is early maturing to allow more than one crop a year, (3) has maximum resistance to disease, and (4) has optimal response to fertilizer. A very promising variety has already been developed called IR8; it resists lodging, maturies in one hundred and twenty days, flowers without regard to seasonal changes in light, and has a high yield experimentally of nine to ten metric tons per hectare and, with proper management, five to seven metric tons on farms in Southeast Asian countries. From viewing the rice plots, one enters the cool white buildings containing laboratories where chemists, geneticists, microbiologists, soil scientists, and the many other research scientists of seven nationalities conduct intensive investigations. The Institute offers resident training in rice research methods and techniques and provides symposia and international conferences.

In the library one finds practically everything that has been written, or at least from twenty-three major languages, in the technical literature on rice. The reading room is filled with students of many countries; here is the center for information on rice.

From the complexities of science and research, one enters another building where the agricultural engineers work on every type of equipment and machinery for tilling, cultivating, harvesting, and threshing rice.

At IRRI everything centers on rice, and one catches a glimpse of what the future holds for the sixty percent of humanity for whom rice is life. This cooperative research endeavor is supplying the information which can be applied to produce more and better food to feed the people of the world's rice bowl.

The Ford Foundation contributed funds for the land, buildings, and initial equipment and, with the Rockefeller Foundation, now shares equally in the operational and maintenance costs.

VOLUNTARY AGENCY PROGRAMS

CARE: Cooperative for American Relief Everywhere

CARE is unique in that every contribution made to it voluntarily supplies a specific item to a specific beneficiary, whether group or individual, and the recipient knows who gave the help. Donors may specify the recipient or they may donate to a larger gift sent with the designation, "a gift from the people of the United States of America."

According to a statement published by CARE, it is "a non-profit United States government-sponsored agency for person to person international aid." It is a joint organization of twenty-six accredited American service agencies embracing those of churches, labor organizations, service clubs, fraternal orders, and federated clubs. Each organization has a member on the CARE Board of Directors which approves all policies and programs. Medico, since 1962 a service of CARE, has its own board of prominent physicians and civic leaders with one representative on the CARE Board.

CARE came into being at the end of World War II when Americans who wanted to send help to relatives and friends in Europe found transportation disrupted and other conditions generally hectic. At this time American welfare organizations, already engaged in relief activities, joined together and formed CARE in November 1945, in the District of Columbia, with the approval of the United States Department of State. The first CARE packages containing food were delivered in Le Havre, France, in May 1946. During the next twenty years, CARE delivered $798,213,112 worth of supplies. It hopes to deliver six and one-half million food packages, each of a value of one dollar, as a part of the overall 1966–1967 CARE plan to feed forty million people in thirty-two countries.

Staff members are stationed in each of the thirty-six countries served. These are mostly in Central and South America, the Near East, Africa, and Asia. The CARE mission chiefs are responsible for reporting specific needs and for supervising deliveries. They also inform the United States office when relief supplies are no longer needed, as was done in post-war Europe after it recovered prosperity.

Food commodities contributed by the United States government make up a large part of the total material CARE distributions. Items which are widely needed are assembled in standard CARE packages. Most buying is done in the United States but, where advisable, local purchases are made to meet local needs. To save money purchases are made directly from manufacturers, processors, publishers, etc. and at

Good school lunches promoted by CARE help Chilean children to be healthy. (Courtesy of World Health Organization)

the CARE plant in Philadelphia, standard packages are assembled. Negotiations with shipping lines and local country transportation attempt to save money. CARE's buying, packing, and shipping practices assure as low a cost as possible. By contract with each foreign government, all CARE supplies are admitted tax and duty free. The costs of packaging, administering, overseas planning, and distributing are all paid for by the voluntary dollar contributions.

CARE also has a self-help program which sends garden tools and seeds, as well as school and vocational training kits.

According to a 1966 CARE publication, typical ways in which help is given are the sending of such as:

1. A twenty-seven pound package of staple foods for one dollar to feed hungry families, refugees, or school children. One hundred dollars send over a ton of food.
2. A two dollar package of seeds which will yield one thousand pounds of vegetables. Fifteen dollars send enough seeds to raise one ton of food, with eleven dollars going for a farm tool to cultivate the seeds.
3. Fifteen dollars inoculate, through Medico, twenty-five children against cholera. Twenty-five dollars provide a typical operation and therapy to enable a cripple to walk.

TABLE 1. NUMBER OF RECIPIENTS IN TITLE III VOLUNTARY AGENCY FOREIGN DONATIONS PROGRAMS UNDER SECTION 302 AS OF DECEMBER 31, 1965

Category	CARE	Catholic Relief Service	Church World Service	UNICEF	Lutheran World Relief	All Other Agencies	Total
Schools	26,926,100	5,912,406	1,382,925	299,940	221,220	164,830	34,907,321
Institutions	621,930	1,708,640	354,560	—	76,920	89,171	2,851,221
Family individuals	2,816,530	8,558,972	675,424	—	227,343	336,502	12,614,771
Family workers	225,864	210,190	86,650	—	28,750	62,190	613,644
Refugees	1,690	358,264	57,720	—	37,630	266,550	721,854
Summer camps	1,514,150	723,380	60,500	—	1,500	8,560	2,308,090
Maternal/child care	1,288,043	1,768,563	340,732	1,521,391	20,860	92,799	5,032,388
Health cases	56,070	1,490,147	292,661	—	22,020	150,348	2,011,246
Feeding centers	154,273	967,459	387,040	—	65,960	81,300	1,656,032
Total recipients	33,604,650	21,698,021	3,638,112	1,821,331	702,203	1,252,250	62,716,567

From: Food For Peace Annual Report, *1965.*

4. A trade tool that costs twenty dollars will help a boy to learn so he can earn a living. Seventy-five dollars will provide a sewing machine so a seamstress can support her family.
5. Ten dollars provide a desk and chair for two school children, one to two dollars (depending on the delivery area) provide writing materials for these two. Fifty-six dollars will start a school library.
6. A one-hundred and ten dollar pump can give a pure water supply and change the life of a village.
7. One thousand dollars to five thousand dollars will buy the materials and implements for villagers to build their own schools.

Nine out of ten of the packages delivered overseas contain food.

It is small wonder that CARE has earned the respect and support of many people in the United States.

Church Service Organizations

For the past several centuries both Protestant and Catholic missionaries have had a record, apart from their religious efforts, of providing medical and educational aid in many countries and also of vigorous and successful help in agriculture in countries such as China, Japan, India, and Africa.

By 1907 a number of United States mission boards had initiated agricultural programs and centers for agricultural training. Space does not permit discussion of these programs nor of the continuing efforts of church groups today, working independently and also in cooperation with national and international agencies in disaster and famine relief, in training programs, and in the establishment of educational institutions where agriculture and home economics are taught. These are but a few of the ways in which the religious bodies of the world are striving, along with many other agencies and organizations, to free the people of the world from hunger and malnutrition. The following are some of the groups with active programs now:

Jewish—American Jewish Joint Distribution Committee
Catholic—Catholic Relief Services
Lutheran—Lutheran World Relief
Seventh Day Adventist—Seventh Day Adventist Welfare Service
Church World Service
Friends—Friend Service Committee

It was said in 1963 that the work of the Church World Service was reaching nearly every needy country, and that it was moving from giving direct relief to helping the people help themselves. This is being done through loans, vocational training, medical and dental clinics, and agricultural projects intended to increase food production. Many American religious denominations help in the distribution of surplus foods to needy people.

Church World Service and Catholic Relief Service have also worked with UNICEF and other voluntary organizations which in turn enlist the aid of the food industry. All of these groups working together are making great contributions to the Food for Peace program.

Such eminent American nutritionists as Dr. Elmer L. Severinghaus and Dr. Clara Mae Taylor are giving valuable assistance to the Nutrition Program of the Church World Service.

The Salvation Army

The Salvation Army, a religious organization with a vast good will and social service program, began its work in 1874 in Wales. Today the services of the Salvation Army extend to all continents of the world. Feeding people in need—the victims of disaster, the poor, the young who are without care, and the old—is one of these services. In the year 1965, the Salvation Army maintained 325 food distribution centers and fed 2,072,964 persons.

The American National Red Cross

The American National Red Cross entered the field of nutrition education in 1908 when it authorized instruction in dietetics as a part of the Home Nursing Service. During the war period, 1917–1918, the Red Cross helped in the recruitment of hospital dietitians and nutrition instructors. At that time some local chapters furnished free milk and hot lunches to school children as an emergency measure. In 1920 the Red Cross Nutrition Service was set up as a separate service with a national director. The program expanded in personnel and services with some local chapters maintaining a full-time nutritionist. Classes in nutrition were taught for both children and adults. In 1932, because of lack of funds, the National Nutrition Service was discontinued except for the retention of a consultant at the national headquarters. In 1941 it was reinstituted and community nutrition programs were initiated. During the war period, the American Red Cross carried on an active community nutrition program. Since 1950 a consultant in nutrition has been maintained at the national headquarters. Local chapters recruit and register nutritionists and dietitians as instructors of canteen courses and supervisors of mass feeding in disaster and to assist Red Cross programs concerned with nutrition.

GENERAL PROGRAMS

As the need for an adequate diet for all peoples has become known and as surveys done in many countries have pointed out dietary inadequacies, new programs for prevention as well as cure of the problems of malnutrition have been devised. Practically every country now has a group working on these problems from several angles. There may be efforts to:

1. Improve the quantity and quality of food at its source. The production of milk is being improved through better breeding, feeding, and care of animals, as well as improved practices of milk processing. One such project is described on page under making food available as a way of improving food habits. Scientists are at work to produce better rice both from the standpoint of the yield per acre and nutritive quality. Research is currently going on to breed higher nutritive quality in such cereal grains as wheat and corn. One of the greatest potential sources of high quality protein, fish from the sea, is currently receiving much attention. This is discussed further on pages 248–249.
2. Prepare mixtures of high nutritive value and test them for acceptability. These include fish-protein concentrate made from whole fish often not readily usable otherwise because of a large bony part in relation to flesh. Several mixtures using locally grown cereals to furnish a high protein for the diet are currently being produced experimentally, tested, and then produced on a commercial scale. Among these are such mixtures as Incaparina, Temph, Pro Nutro, Fortifex, and Laubina which are now in commercial production for use in countries where protein-calorie malnutrition has created a need to improve the quality and quantity of protein foods.

   Both the fish-protein concentrates and these cereal mixtures may be, and often are, added to other foods. The latter may also be used as a drink after mixing with water and cooking for a short period.
3. Produce a highly nutritious food new to a region. Fish ponds to furnish a supply of fresh water fish have been built, stocked, and constantly improved, often with the technical assistance of such international agencies as FAO and AID.

   The introduction of improved varieties of grains, vegetables, and fruits into countries where they have not previously been grown has often resulted in a more nutritious food supply. In some cases, such as the vitamin C-high acerola cherry which Dr. Lydia J. Roberts and her group promoted in Puerto Rico, the food may have been in the country but its culture may have been neglected previously.

4. Make nutritious foods available where needed, as illustrated by some work now being done under Dr. A. G. van Veen at Cornell University. He and his group are investigating the nutritive advantages of a food used in South India called idli. It is a well-known and accepted food made by fermenting a batter of parboiled rice and a black gram. It is eaten in the form of a cookie, has a slightly sour taste, and is believed to be high in some essential amino acids and vitamins.

For all of these efforts, needs must first be investigated through dietary surveys. Then efforts in coordinating services of raising food, marketing, and distribution, as well as educating the public to use the food, are vital. As has been so often said, those programs which originate at high government level but which consider at every step the people who are to eat the food are the only ones which succeed.

STUDY QUESTIONS

1. Helping people help themselves is a current approach to world food problems. Can you describe several examples of such actions and evaluate the value of such an approach?
2. To what extent may each problem be expected to be overcome, and how might this be achieved? What are some obstacles to international collaboration in food and agriculture?
3. Why was CARE founded and how do its purposes differ from other international service organizations?
4. How do the programs of UNICEF, FAO, and WHO differ?
5. How is prevention built into an international program under FAO or UNICEF?
6. Why was it possible for FAO to be founded after World War II?
7. What is P.L. 480 and how are funds accruing from it used to benefit a country?

TOPICS FOR INDIVIDUAL INVESTIGATION

1. Evaluate the success and failures of international organizations and their program for improvement of food supply and nutrition of man. Com-

pare the advantages and disadvantages of international efforts with group efforts or the people-to-people approach.

2. FAO made 1966 the International Rice year. Discuss the reasons for this and tell what the food value of rice is to the world's population.

3. Select one UNICEF project in a particular country. If you can find the needed data, show how the planning and eventual takeover by the government of that country followed the stated objectives of UNICEF. If you cannot find all of these data, write a possible plan which would fulfill all of these objectives.

4. Select one nutrition project in one country and outline the procedure step by step as WHO offered assistance. Show any cooperation of another United Nations agency if such were afforded.

5. Decide if you think it is possible for all people of the world to be adequately fed. Present figures on population and food production in support of your answer.

6. The Latin American countries have long worked together through the Pan American Sanitary Bureau (1902). Describe current programs which have been developed to help the food needs of one country (choose any one) in Latin America. Discuss the strengths and weaknesses of these programs.

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Appendix 3

GLOSSARY

abalone—an edible sea mollusk.

AID—Agency for International Development.

amenorrhea—absence of the menses.

amino acids—often called the "building stones" of a protein.

Antolian Greece—a former district in Asia Minor generally known as Turkey in Asia.

Andalusian cattle—cattle from the District of Andalusia in Southern Spain.

Athenian—citizen of Athens, Greece.

anthropometric measurements—measurements of the human body.

basal metabolism—the amount of heat given off during physical, digestive, and emotional rest. It represents the amount of energy needed to carry on the body processes necessary for life.

biological value of a protein—the amount of the protein which can be used by the organism.

bouillabaisse—a French soup made from several kinds of seafoods, wine, and seasonings.

Buddha—Indian philosopher, founder of Buddhism, 563–483 B.C.

Calorie—the unit used to measure energy. The number of calories in foods denotes their energy value.

Carthage—an ancient country and city in North Africa which was destroyed by the Romans in 146 B.C.

chronology—the science which measures time by regular divisions and which assigns to events their proper dates.

cretinism—a disease in which there is deficiency of thyroid secretion.

Dante—Italian poet, 1265–1321 A.D.

debilitation—the state of becoming feeble.

demographic—pertaining to the statistics of births, deaths, and diseases.

dyspigmented—a condition in which pigment in the tissue is decreased.

edema—a condition in which watery fluid collects in body tissues.

FAO—Food and Agriculture Organization of the United Nations.

fermentation—a change brought about by a ferment such as a yeast with the production of carbon dioxide and alcohol.

FFHC—Freedom from Hunger Campaign under Food and Agriculture Organization.

Flavius Vespasian—Roman emperor, 69–79 A.D.

folic acid—one of the numerous B vitamins.

Gauls—natives of an ancient territory embracing what is now Northern Italy, France, Belgium, and parts of Holland, Switzerland, and Germany.

glacial period—the period when large areas of the temperate and frigid zone were covered by slowly moving ice fields during the early geological epochs that transported vast masses of drift to lower latitudes.

herbivore—animals feeding on plants, generally ungulates.

hypoglycemia—a condition in which the blood sugar falls too low.

hydrogenated fat—fat which has been made hard by forcing hydrogen to combine with the fatty acids.

indigenous—produced naturally in a region.

IIA—International Institute of Agriculture.

ILO—International Labor Office.

INCAP—Institute of Nutrition of Central America and Panama.

Iodized salt—salt to which potassium iodide has been added.

IRRI—International Rice Research Institute in Los Banos, Philippines.

kolachie—a sweet, middle-European, filled bun.

lefse—a thin, Scanidinavian, soft bread.

limpa—rye bread flavored with orange peel and fennel seed.

lingon berries—small red berries which grow wild in some northern countries and have a wine flavor.

locusts—destructive and migrating grasshoppers of eastern Europe, Africa, and Asia.

lutefisk—cod soaked in lye to soften the flesh; a Swedish preparation for cod.

maize—corn.

Malabar—a district in West Madras, India.

Malthus—An English economist, 1766–1834, who held that the population increases faster than the means of support unless checked by famine, pestilence, and war; he proposed social and moral restraints.

mammoth—a very large extinct elephant with enormous tusks.

megaloblastic macrocytic anemia—a type of anemia characterized by immature, oversized, red blood cells.

Melanesia—a group of islands in the Western Pacific Ocean.

Mesopotamia—the country between the Tigres and Euphrates rivers.

metabolic—changes within a cell by which food is built up into living protoplasm and broken down into energy and waste products.

miso soup—Japanese soup often used for breakfast.

Mozambique—a district in Northern Portuguese East Africa.

NAS/NRC—National Academy of Sciences of the National Research Council.

neonatal—the newborn child up to four weeks of age.

Nero—Roman emperor, 37–68 A.D., notorious for his cruelty, who ruled from 54–68 A.D.

NGO—Nongovernment organizations.

niacin—one of the numerous B vitamins.

osteoporosis—decreased deposition of calcium in the bones, resulting in soft and brittle bones.

paella—a Spanish rice dish containing vegetables and meat or chicken.

PAHO—Pan American Health Organization.

papaya—a yellow tropical fruit with a thick fleshy rind and numerous black seeds.

pasta—Italian wheat preparations such as spaghetti, macaroni, vermicelli, and other less well-known forms of this dried wheat paste.

pathogenic—producing disease.

Phoenicians—natives of an ancient semitic country north of Palestine and east of Syria. The country flourished from the sixteenth to the second century B.C. Its chief cities were Tyre and Sidan.

PHA—Public Health Service.

Pliny—A roman naturalist and author, 23–79 A.D.

Plutarch—a Greek moralist and biographer, 46–120 A.D.

poi—a dish made in Hawaii from the root of the taro plant.

Polynesia—collective name for numerous small islands in the Pacific Ocean east of Australia and Malaya.

Po Valley—valley in northern Italy that was prominent in earliest market gardening.

prehistoric man—man existing in the period before written history.

primeval man—first man belonging to the first ages.

pro-vitamin—a substance which can be converted into a vitamin.

psychomotor—inducing movement by psychic or mental action.

putrefaction—to rot or decay with an offensive odor.

radiograph—x-ray.

riboflavin—one of the numerous B vitamins.

Saracens—originally nomads of the desert between Syria and Arabia; later an Arab, hence a Moslem.

selenium—a mineral of which minute amounts are possibly needed for human nutrition.

severalty—a holding by individual right.

solstice—one of the two times a year midway between the two equinoxes when the sun is farthest from the equator—about the twenty-first of June or the twenty-second of December.

sorghum—a cereal plant also called Indian millet and milo.

sukiyaki—a Japanese dish made of pieces of meat, vegetables, and soy sauce.

supplemental fare—foods fed to infants in addition to breast or bottle milk.

taboo—forbidden.

tartars—members of any of numerous tribes or hordes, mostly Turkic, inhabiting parts of Russia and central and western Siberia.

Teutonic tribesman—tribesman of one of the ancient German tribes.

thiamine—one of the numerous B vitamins.

Tibet—western part of China.

Tigris Euphrates Valleys—valleys in southeast Turkey in Asia and Iraq that were prominent in earliest agriculture.

toxemia—a general intoxication due to the absorption of bacterial products (toxins) formed at a local source of infection.

tundra—one of the level or undulating treeless plains of the arctic regions.

UN—United Nations.

UNESCO—United Nations Education, Scientific and Cultural Organization.

ungulates—any of a group consisting of the hoofed mammals such as the ruminants, swine, horses, tapirs, rhinoceroses, elephants, and conies. Nearly all are exclusively herbivorous and many have horns.

UNICEF—United Nations International Children's Fund. The E was left in when the agency title dropped the word *emergency*.

unleavened bread—bread which has no agent in it to cause it to become light and porous.

urolithiasis—the formation of urinary calculi.

USDA—United States Department of Agriculture.

Valley in Pakistan—one of the cradles of earliest agriculture.

Valley of Nile—valley in East Africa that was prominent in earliest agriculture, especially as a wheat producer.

Valley of Yellow River—valley of second largest river in China now known as Huang Ho. It is twenty-seven hundred miles long and flows into the Yellow Sea.

Vandals—a germanic people anciently dwelling south of the Baltic between the Vistula and the Oder River. In the fourth and fifth centuries they overran Gaul, Spain, and northern Africa and, in 455 A.D., sacked Rome.

whey—the watery part of milk which remains after the separation of the curd by coagulation.

WHO—World Health Organization.

yaws—a serious tropical disease causing disfiguration.

YWA—Young World Appeal under Food and Agriculture Organization.

YWFD—Young World Food and Development Project under Food and Agriculture Organization.

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